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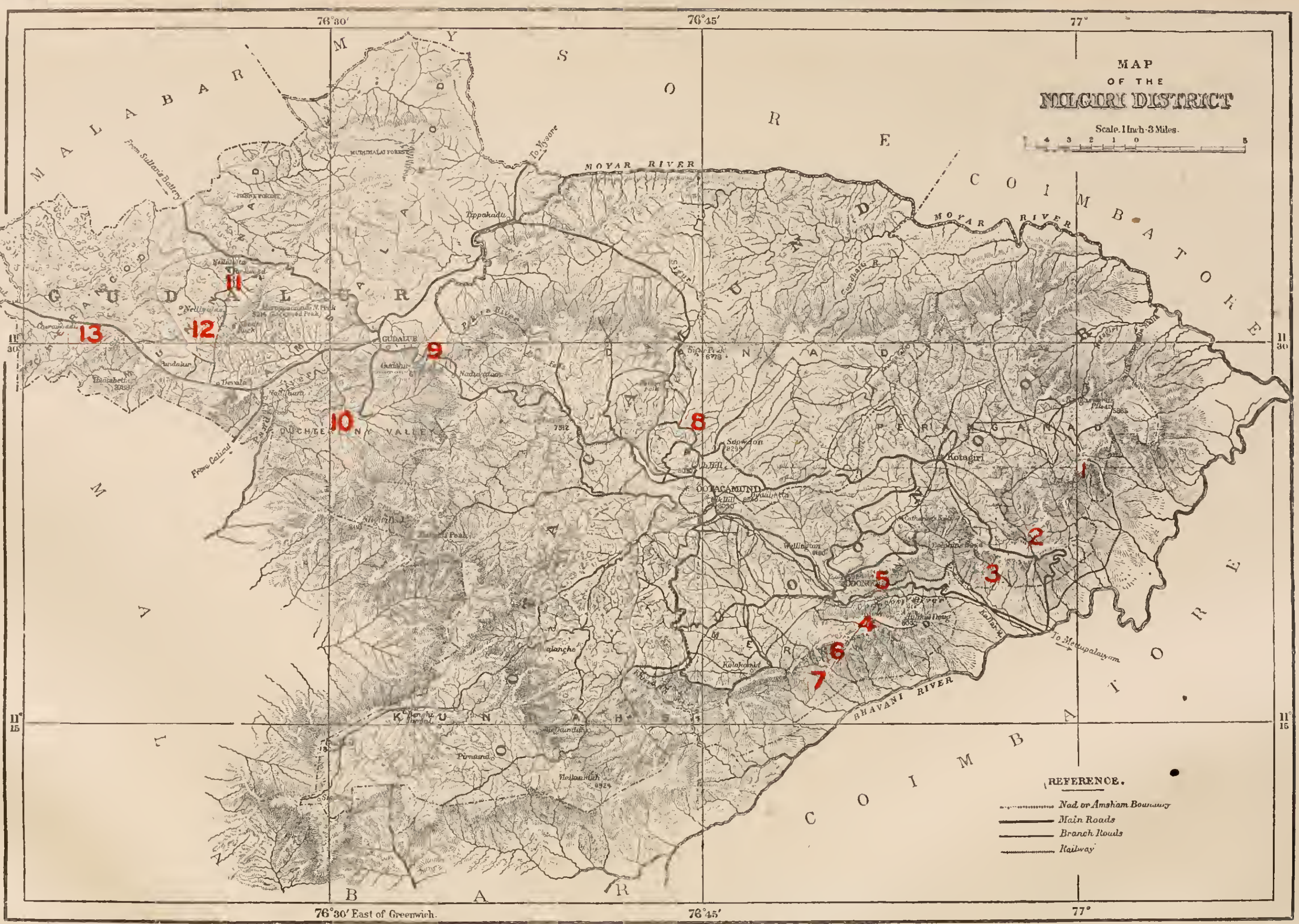
MAP OF THE NILGIRI DISTRICT
Scale. 1 Inch-3 Miles.
REFERENCE.
Nad or Amsham Boundary
Main Roads
Branch Roads
Railway
MALABAR
MYSORE
COIMBATORE
MOYAR RIVER
BHAVANI RIVER
GUDALUR
OOTACAMUND
Kotagiri
COONOOR
OUCHTERLONY VALLEY
76°30′ East of Greenwich.
76°45′
77°
11° 30
11° 15
1
2
3
4
5
6
7
8
9
10
11
12
13

NILGIRI SNAKES.

1. Rookery Estate
2. Adderley ,,
3. Hill Grove ,,
4. Glendale Estate
5. Coonor
6. Erith Hall Estate
7. Pilloor Estate
8. Kalhatti
9. Liddelsdale Estate
10. Hope Estate
11. Rockwood ,,
12. Mayfield ,,
13. Wentworth Estate

1 to 9. Nilgiri Hills
10 ,, 13. Wynaad

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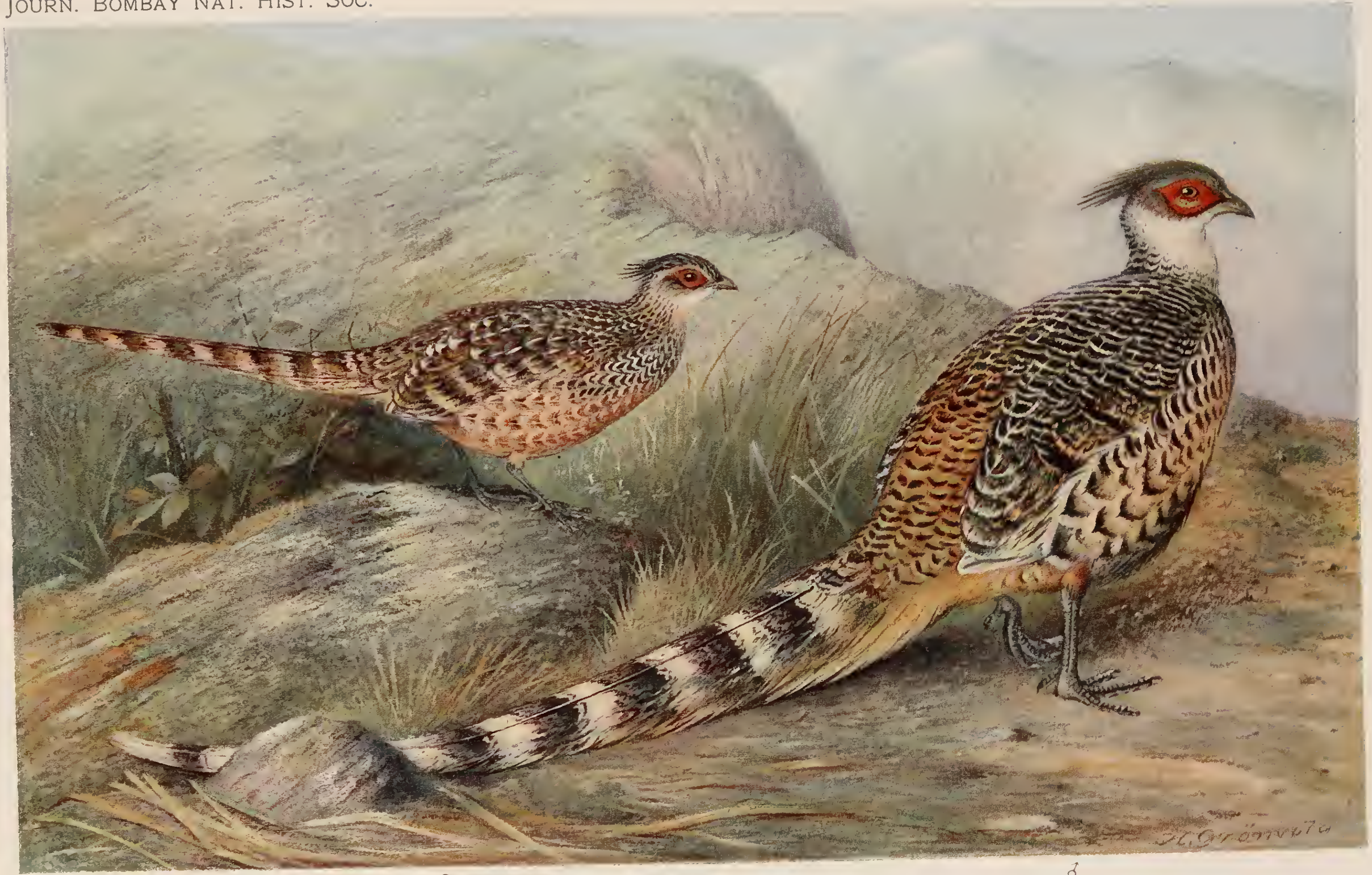

MENPES PRESS, WATFORD

CATREUS WALLICHII.

The Cheer Pheasant.

CONTENTS OF VOLUME XXVI.

No. 1.

PAGE

THE GAME BIRDS OF INDIA, BURMA AND CEYLON. Part XXV. (*With a Plate of Catreus wallichi*, the Cheer Pheasant). By E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U. 1

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY OF THE BOMBAY NATURAL HISTORY SOCIETY. Part II. By R. C. Wroughton, F.Z.S. 19

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, No. XVIII. Report on the House Rats of India, Burma and Ceylon. By Martin A. C. Hinton 59

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part XXVI. (*With Plate XXVI and Diagram of Cerberus rhynchops* and *Enhydris curtus.*) By Lt.-Col. F. Wall, C.M.G., C.M.Z.S., F.L.S., I.M.S. 89

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXI. By T. R. Bell, I.F.S., C.I.E. 98

INDIAN DRAGONFLIES. Part III. (*With 12 Text-figures.*) By Major F. C. Fraser, I.M.S. 141

NOTES ON THE BIRDS OF AMBALA DISTRICT, PUNJAB. Part II. By H. Whistler, M.B.O.U., F.Z.S. 172

THE *CYPERACEÆ* OF THE BOMBAY PRESIDENCY. Part II. By L. J. Sedgwick, F.L.S., I.C.S. 192

A REVISION OF THE INDIAN SPECIES OF *ROTALA* AND *AMMANNIA*. Part II. By E. Blatter, S.J., and Prof. F. Hallberg 210

THE FLORA OF THE INDIAN DESERT. (JODHPUR AND JAISALMER). Part I. (*With 12 Plates.*) By E. Blatter, S.J., and Prof. F. Hallberg 218

THE BIRDS OF PREY OF THE PUNJAB. Part I. (*With 2* plates at [illegible] *~~Diagrams.~~*) By C. H. Donald, F.Z.S. 247

PANTHERS. By Brig.-General R. G. Burton.................. 266

THE MESOPOTAMIAN BULBUL. By Capt. Claude B. Ticehurst, R.A.M.C. 279

note fro [illegible]

52099

PAGE

MISCELLANEOUS NOTES:—

I. Notes on a Young Hog-Badger (*Arctonyx, sp.*) in the Garo Hills. By V. A. Jackson. 281

Further Notes on the Hog-Badger. By V. A. Jackson 281

II. Porcupine's Mode of Attack. By Reginald H. Heath 282

III. Method of Porcupine's Attack. By Lt.-Col. E. O'Brien 283

IV. Method of Porcupine's Attack. By F. J. Mitchell 283

V. The Beatrix or Arabian Oryx (*Oryx leucoryx* in Central Arabia. (*With a Plate.*) By Lt.-Col. R. E. A. Hamilton 283

VI. Notes on a Takin Head from Assam. By J. P. Mills, I.C.S. 284

VII. Panic in Elephants during an Earthquake. By V. A. Jackson, F.R.G.S. 285

VIII. On White Elephants H. Macnaghten ... 285

IX. The White-cheeked Bulbul (*Molpastes leucogenys.*) By Brig.-General R. M. Betham. 286

X. The Plumage of the Purple Honeysucker (*Arachnecthtra asiatica.*) By Capt. Claude B. Ticehurst, R.A.M.C. 286

XI. Note on the Indian Long-billed Vulture (*Gyps indicus.*) By W. H. Mathews, I.P. 287

XII. The Common Hawk-Cuckoo (*Hierococcyx varius*) in the Punjab. By H. Whistler, F.Z.S., Indian Police 287

XIII The Breeding Habits of Mrs. Hume's Pheasant. By Capt. R. Blandy 289

XIV. Notes on Kalij Pheasants in the Chin Hills. By Capt. R. Blandy 289

PAGE

XV. Occurrence of the Lesser Florican or Likh (*S. aurita*), in the Mahableshwar Hills. By Kyrle Fellowes 289

XVI. Abnormal Varieties of the Indian Redstart (*R. rufivenrits*) and the Common House Crow (*C. splendens.*) By H. Whistler, F.Z.S., Indian Police.......................... 289

XVII. The Colour of the Eye of the Female White-eyed Pochard (*Nyroca africana*). By Capt. Claude B. Ticehurst, R.A.M.C. 290

XVIII. Notes on the Habits of the Mallard (*Anas boscas*). By Lt.-Col. E. J. D. Colvin ... 291

XIX. An addition to the Game Birds of Burma. The Long-billed Hill Partridge (*Rhizothera longirostris*, Temn.) in Tenasserim. By Chas. M. Inglis, M.B.O.U. 291

XX. Natural History Notes from Fao. By W. D. Cumming 292

XXI. How Trout were introduced into Kashmir. By F. J. Mitchell 295

XXII. Notes on the Larva of *Chærocampa alecto*. By Capt. F. B. Scott, I.A. 299

XXIII. Life History of *Antheræa roylei*, the Oak Emperor Moth. By C. W. Allan 300

XXIV. A Flight of Locusts (*With a Plate*). By E. C. B. Acworth 301

XXV. Nesting Habits of *Vespa dorylloides*, Sauss. By C. F. C. Beeson, M.A., I.F.S. 301

XXVI. Mimicry in Spiders. By F. Clayton 302

XXVII. On the Breeding Habits of some *Myriapoda*. By C. McCann 303

XXVIII. Note on a new undescribed Species of *Cynodon* (*With a Plate.*) By K. Rangachari and C. Tadulingam.................... 304

PAGE

XXIX. A Variety of *Butea frondosa*. By Lt.-Col. C. E. Luard 305
XXX. The Edible Date-Palm in Bombay. By Rev. E. Blatter, S.J. 306
XXXI. Oleander poisoning Camels. By Capt. J. E. B. Hotson, I.A.R.O. 306
XXXII. Notes from the Oriental Sporting Magazine. New Series, 1869 to 1879. By Lt.-Col. R. W. Burton, I.A. 309
XXXIII. Nilgiri Trap for catching Wild Animals. By Capt. Philip Gosse, R.A.M.C. 311
XXXIV. *Eleocharis congesta*, Don., in the Bombay Presidency. By L. J. Sedgwick, I.C.S. ... 312
PROCEEDINGS.. 313—318

No. 2.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON. Part XXVI. (*With a Plate of Lophophorus impejanus*, the Impeyan Pheasant or Monal.) By E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U. 319
SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY OF THE BOMBAY NATURAL HISTORY SOCIETY. Part III. By R. C. Wroughton, F.Z.S. 338
ON ASIATIC STARLINGS. By Capt. C. B. Ticehurst, R.A.M.C. 380
SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY NO. XVIII (*contd.*) Report on the House Rats of India, Burma and Ceylon. By Martin A. C. Hinton 384
SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, NO. XIX. A Synopsis of the Groups of True Mice found within the Indian Empire. By Oldfield Thomas, F.R.S. 417
A NEW SPECIES OF *NESOKIA* FROM MESOPOTAMIA. By Oldfield Thomas, F.R.S. 422
SUPPLEMENTARY NOTES ON SOME INDIAN BIRDS. By B. B. Osmaston, C.I.E., I.F.S. 424

PAGE.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part XXVII. (*With Plate XXVII* and Diagram of *Hydrophis spiralis* and *Hydrophis cyanocinctus*. By Lt.-Col. F. Wall, C.M.G., C.M.Z.S., F.L.S., I.M.S. 430

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXII. (*With Plate H.*) By T. R. Bell, C.I.E., I.F.S.. 438

INDIAN DRAGONFLIES. Part IV. (*With* 14 *Text-figures*). By Major F. C. Fraser, I.M.S. 488

SUB-SPECIES AND THE FIELD NATURALIST. By E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U. 518

THE FLORA OF THE INDIAN DESERT. (JODHPUR AND JAISALMER). Part II. (*With* 13 *Plates.*) By E. Blatter, S.J., and Prof. F. Hallberg 525

NOTES ON A COLLECTION OF SNAKES MADE IN THE NILGIRI HILLS AND THE ADJACENT WYNAAD. (*With Diagram and maps.*) By Lt.-Col. F. Wall, C.M.G., C.M.Z.S., F.L.S., I.M.S. 552

SOME BIRDS OF LUDHIANA DISTRICT, PUNJAB. By H. Whistler, F.Z.S., M.B.O.U. 585

REDUCTION OF *EUPHORBIA ROTHIANA*. By L. J. Sedgwick, F.L.S., I.C.S. 599

A LIST OF BIRDS FOUND IN THE SIMLA HILLS, 1908-1918. By A. E. Jones 601

SOME SOUTH INDIAN COCCIDS OF ECONOMIC IMPORTANCE. (*With* 4 *Plates.*) By T. V. Ramakrishna Ayyar, B.A., F.E.S., F.Z.S. 621

THE BIRDS OF PREY OF THE PUNJAB. Part II. (*With Plates I and II.*) By C. H. Donald, F.Z.S................ 629

PROGRESS OF THE MAMMAL SURVEY 656

MISCELLANEOUS NOTES :—

I. The Tiger and the Train. By A. A. Dunbar Brander, I.F.S. 658

II. Arrow head imbedded in a Tiger's back. By J. G. Ridland 658

PAGE

III. Size of Tigers. By Lt.-Col. R. Light......... 659

IV. Tigress (*Felis tigris*) attacking a Sloth Bear (*Melursus ursinus*). By J. A. Duke 659

V. Mongoose (*Mungos mungo*) killing a Hedgehog. By Lt.-Col. E. O'Brien........... 660

VI. Natural Death of a Fox (*Vulpes bengalensis*). By G. O. Allen, I.C.S. 660

VII. Spotted Deer (*Axis axis*) and Wild Dogs (*Cuon dukhunensis*). By J. A. Duke...... 661

IX. Porcupine's method of shedding quills when attacked. By Lt.-Col. R. Light........... 666

X. Record Female Nilgiri Tahr. (*Hemitragus hylocrius*). By Lt. A. P. Kinloch 666

XI. Indian Grey Shrike (*Lanius lahtora*) attacking wounded Sandgrouse. By Lt.-Col. E. O'Brien 667

XII. Occurrence of Indian Red-breasted Flycatcher (*Siphia hyperythra*) in the Deccan. By A. J. Currie 667

XIII. Nesting habits of the Brown Rockchat (*Cercomela fusca*). By L. S. White 667

XIV. A note on the large Brown Thrush (*Zoothera monticola*). By S. J. Martin 668

XV. Nidification of the Smaller Streaked Spiderhunter (*Arachnothera aurata*). J. M. D. Mackenzie, I.F.S., M.B.O.U., F.Z.S. 669

XVI. The Malabar Pied Hornbill (*Anthracoceros coronatus*) in Mirzapur, U. P. By G. O. Allen, I.C.S. 671

XVII. The Cuckoo (*Cuculus canorus*) in Mirzapur, U. P. By G. O. Allen 671

XVIII. Extension of Range of the Bronze-winged Dove. By H. Dawson 672

XIX. Habits of the Painted Sandgrouse (*Pterocles fasciatus*). By G. O. Allen, I.C.S. 672

PAGE

XX. Sandgrouse in Mesopotamia. By Lt.-Col. H. A. F. Magrath 672
XXI. The Burmese Peafowl (*Pavo muticus*) in the Chittagong Hill Tracts, Bengal. By C. M. Inglis 673
XXII. Nidification of Stone's Pheasant (*Phasianus elegans*). A correction. By C. M. Inglis. 673
XXIII. The Great Indian Bustard (*Eupodotis edwardsi*) in Mirzapur District, U. P. By G. O. Allen, I.C.S.. 673
XXIV. Note on the occurrence of the Lesser Florican or Likh (*Sypheotis aurita*) in Bombay. By N. Marryat.................................... 674
XXV. The Cotton Teal in Malabar. By A. M. Kinloch 674
XXVI. Occurrence of the Common Sheldrake (*Tadorna cornuta*) and the Marbled Duck (*Marmaronetta angustirostris*) in Kathiawar. By Lt.-Col. H. W. Berthon.................. 674
XXVII. Spot-billed Duck in Kashmir. By Maj. D. J. Oliver 675
XXVIII. The Sheldrake (*Tadorna cornuta*) in Manipur State. By J. C. Higgins, I.C.S. 675
XXIX. Further note on the Birds of Ambala District, Punjab. By A. E. Jones 675
XXX. List of Birds observed in the Euphrates Valley. By Major General H. T. Brooking 677
XXXI. Large Carp from Mesopotamia. By Major R. Bagnall 679
XXXII. Large Carp from Mesopotamia. By Brig.-General H. Mackay, R.A. 680
XXXIII. The Habits of the Tree Frog (*Rhacophorus maculatus*). By G. O. Allen, I.C.S.......... 681
XXXIV. The Habits of *Dryophis mycterizans*. By A. M. Kinloch 681

PAGE

XXXV. The Bite of the Large Spotted Viper (*Lachesis monticola*). By A. Wright 681

XXXVI. Remarks on Col. Wall's identification of *Hydrophis cyanocinctus*. By Malcolm A. Smith, F.Z.S. 682

XXXVII. Notes on Some Interesting Snakes recently presented to this Society. By S. H. Prater.. 683

XXXVIII. The undescribed Female of an Indian Dragonfly (*Hemicordulia asiatica*). By Major F. C. Fraser, I.M.S............................. 685

XXXIX. Libellulines at St. Thomas' Mount, Madras. By H. R. Rishworth.......................... 685

XL. A note on the function of the "Forceps" in *Forficulidæ*. By Lt.-Col. F. Powell Connor, I.M.S. 688

XLI. Some Butterflies taken in Benares and Adjoining Districts. By G. O. Allen, I.C.S. 689

XLII. Notes on the Emergence from the Cocoon in *Lasiocampidæ*. By Lt.-Col. F. P. Connor, I.M.S.. 691

XLIII. Tenacity of life of *Parapolybia orientalis*. By G. O. Allen, I.C.S. 693

XLIV. Protective habits of the Larva of *Trypanophora semihyalina*. By G. O. Allen, I.C.S. 693

XLV. Note on the supposed effects of the bite of a Pentatomid Bug (*Halys dentatus*). By E. H. Hunt 694

XLVI. A few Additions to the List of Mussoorie Plants, by James Marten, in Vol. XIX, p. 475. By G. O. Allen, I.C.S. 695

XLVII. On the Indentity of *Blastospora butleri* Syd. (*With a Plate.*) By S. L. Ajrekar, B.A.... 697

PROCEEDINGS ....698—703

PAGE

No. 3.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON. Part XXVII. (*With a coloured Plate of Tragopan*). By E. C. Stuart Baker, F.Z.S., F.R.S., M.B.O.U. 705

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, NO. XVIII (*contd.*). Report on the House Rats of India, Burma and Ceylon. By Martin A. C. Hinton 716

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, NO. XX. By Oldfield Thomas, F.R.S. 726

A.—Notes on the Genus *Cheliones.*

B.—Change of Coat in the Common Palm Squirrel—An Appeal. By R. C. Wroughton, F.Z.S.

C.—Two new forms of the *Funambulus tristriatus* (Group). By R. C. Wroughton and Winifred M. Davison.

D.—On the Genus *Tadarida* (Wrinkle-Lip Bats). By R. C. Wroughton, F.Z.S.

INDIAN DRAGONFLIES. Part V. (*With Text-figures*). By Major F. C. Fraser, I.M.S. 734

SOME NEW MAMMALS FROM MESOPOTAMIA. By Oldfield Thomas, F.R.S., F.Z.S. 745

COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXIII. By T. R. Bell, C.I.E., I.F.S. 750

SOME BIRDS OBSERVED AT FAGOO, NEAR SIMLA. By H. Whistler, F.Z.S., M.B.O.U. 770

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY OF THE BOMBAY NATURAL HISTORY SOCIETY. Part IV. By R. C. Wroughton, F.Z.S. 776

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part XXVIII (*With a coloured Plate XXVIII and Diagram*). By Lt.-Col. F. Wall, C.M.G., C.M.Z.S., F.Z.S., I.M.S. 803

THE FLORA OF THE INDIAN DESERT. (JODHPUR AND JAISALMER). Part III. (*With 6 Plates.*). By E. Blatter, S.J., and Prof. F. Hallberg 811

PAGE

A TENTATIVE LIST OF THE VERTEBRATES OF THE JALPAIGURI DISTRICT, BENGAL. (*With Plates*). By Chas. M. Inglis, M.B.O.U., W. L. Travers, H. V. O'Donel and E. O. Shebbeare, I.F.S. 819

THE BIRDS OF PREY OF THE PUNJAB. Part III. (*With Plate I*). By C. H. Donald, F.Z.S. 826

MISCELLANEOUS NOTES :—

I. Note on the Malabar Slender Loris, (*Loris lydekkerianus*). By N. B. Kinnear, C.M.Z.S. 836

II. Tiger (*Felis tigris*) climbing Tree. By G. Monteath, B.A., I.C.S. 837

III. Wild Dogs (*Cuon dukhunensis*) and Sambhur. By F. Ware 837

IV. Distribution of the different races and species of Takin (*Budorcas*). By F. Kingdon-Ward. 838

V. Notes on the Big Game and Duck of Dhar State. By H. H. Udaji Rao Puar, K.C.S.I., K.B.E., Maharaja of Dhar 841

VI. Variety of the Common House Crow (*Corvus splendens*) at Jhang, Punjab. By Hugh Whistler, F.Z.S. 843

VII. Maternal instinct in the Pied Bush-Chat, (*Pratincola caprata*). By S. M. Robinson. 843

VIII. Nesting habits of the Brown Rockchat (*Cercomela fusca*). By W. H. Mathews 843

IX. An Albino Swallow. By W. H. Mathews... 844

X. Abnormal variety of the Green Bee-Eater. (*Merops viridis*). By Hugh Whistler, F.Z.S. 844

XI. Some Birds of Prey of Mesopotamia. By C. H. Donald, F.Z.S. 845

XII. Extension of Range of the Green Imperial Pigeon (*Carpophaga œna œna*) in Western India. By N. B. Kinnear, C.M.Z.S. 846

PAGE

XIII. Extracts from "A Monograph of the Pheasants by William Beebe." By Chas. M. Inglis, M.B.O.U. 847
XIV. The Black-Breasted Kalij Pheasant (*Gennæus horsfieldi horsfieldi*) east of the Irrawaddy. By Chas. M. Inglis, M.B.O.U. ... 848
XV. A note on the breeding of the Hill Patridge *Arboricola torqueola* near Simla. By Hugh Whistler, F.Z.S. 849
XVI. Late stay of Common Snipe (*Gallinago cœlestis*) in Central India. By Percy Hide ... 849
XVII. Late stay of Pin-tail Snipe (*Gallinago stenura*) in Burma. By A. F. M. Slater. 850
XVIII. Migration of Snipe in Burma. By E. T. Kenny 850
XIX. Feeding habits of the Little Egret (*Herodias garzetta*). By H. R. Meredith 852
XX. Further occurrence of the Rose-coloured Starling (*Pastor roseus*) and the Flamingo (*Phœnicopterus roseus*) in the Darbhanga District, Behar. By Chas. M. Inglis, M.B.O.U. 853
XXI. Different Birds nesting in Company. By W. Mathews 853
XXII. Notes on some nests recently found in South Tenasserim. By Cyril Hopwood, M.B.O.U. 853
XXIII. Mesopotamian Bird Notes. By F. C. R. Jourdain 860
XXIV. The Giant Tortoise living in Ceylon. (*With a Plate*). By N. B. Kinnear, C.M.Z.S. ... 861
XXV. The Rudimentary hind limb in an Embryo of *Python molurus*. By Lt.-Col. F. Wall, I.M.S. 862
XXVI. The Habits of the Green Whip-Snake (*Dryophis mycterizans*). By J. F. Cains, S.J. ... 862

PAGE

XXVII. Note on the snake *Trirhinopholis nuchalis* (Boulenger). By Lt.-Col. F. Wall, I.M.S. 863

XXVIII. A Gravid Specimen of the Snake *Cylindrophis maculatus* (Linn.). By Lt.-Col. F. Wall, I.M.S. 863

XXIX. Reply to Dr. Malcolm Smith's remarks in the last Journal. By Lt.-Col. F. Wall, I.M.S. 864

XXX. Notes on some recent additions to our Society's Snake collection. By Lt.-Col. F. Wall, I.M.S. 865

XXXI. Occurrence of *Stichopthalma godfreyi* (Roths). By O. C. Ollenbach 867

XXXII. Occurrence of *Colotis vestalis* and *amata* at Unao. By G. O. Allen, I.C.S. 868

XXXIII. Early appearance of *Pieris brassicæ* (Linn.) in the Darbhanga District, Behar. By Chas. M. Inglis 869

XXXIV. Notes on the habits of Butterflies (*Zeuxidia masoni* and *Xanthotænnia busiris*). By O. C. Ollenbach 869

XXXV. Naini Tal Butterfly Notes. By G. O. Allen, I.C.S. 870

XXXVI. Life History Notes on Coorg Butterflies. By F. Hamilton, I.C.S. 871

XXXVII. The Hawk Moth (*Deilephila livornica*). A correction. By Capt. F. B. Scott, I.A. ... 872

XXXVIII. *Harpactor costalis*, Stal, preying on *Ceratina viridissima*, D. T. By Chas. M. Inglis, M.B.O.U. 872

XXXIX. Notes on the Flying White Ants and Scorpions that feed on them. By C. H. Dracott 873

XL. Notes on some new and other Indian Dragonflies. By Major F. C. Fraser, I.M.S. ... 874

PAGE

XLI. Ants attacking Bees. By A. G. H. Breithaupt 878
XLII. Habits of Earth Worms. By G. O. Allen, I.C.S. 879
REVIEW. A practical handbook of British Birds 880
PROCEEDINGS 882

No. 4.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON. Part XXVIII. With a Coloured Plate, *Tragopan blythi blythi.* By E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U.... 885
SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, NO. XVIII (*concld.*). Reports on the House Rats of India, Burma and Ceylon. By Martin A. C. Hinton 906
INDIAN DRAGONFLIES. Part VI. (*With Text-figures.*) By Major F. C. Fraser, I.M.S.. 919
SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, NO. XXI.
A.—Some New Mammals from Baluchistan and North West India. By Oldfield Thomas, F.R.S. 933
B.—Two new species of *Calomyscus.* By Oldfield Thomas, F.R.S. 938
THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXIV. By T. R. Bell, C.I.E., I.F.S. 941
SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY OF THE BOMBAY NATURAL HISTORY SOCIETY. Part V. By R. C. Wroughton, F.Z.S. 955
THE FLORA OF THE INDIAN DESERT (JODHPUR AND JAISALMER). Part IV. By E. Blatter, S.J., and Prof. F. Hallberg. 968
A TENTATIVE LIST OF VERTEBRATES OF THE JALPAIGURI DISTRICT, BENGAL. Part II. (*With a Plate, Map and Test Block*). By Chas. M. Inglis, M.B.O.U., W. L. Travers, H. V. O'Donel and E. O. Shebbeare, I.F.S. ... 988
THE BIRDS OF PREY OF THE PUNJAB. (*With Text figures*) Part IV. By C. H. Donald, F.Z.S......................... 1000

PAGE

NOTES ON INDIAN BUTTERFLIES. By Lt.-Col. W. H. Evans, F.Z.S., F.E.S. 1021

DESCRIPTION OF A NEW SNAKE OF THE GENUS *CONTIA*, B. AND G., FROM PERSIA. By G. A. Boulenger.......... 1024

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON. Report Nos. 30, Deccan (Poona District), and 31, Nilgiris 1025

PROGRESS OF THE MAMMAL SURVEY.......... 1036

OBITUARY NOTICES: F. Hannyngton, I.C.S., E. W. Ellis, I.F.S. 1037

MISCELLANEOUS NOTES:—

I. Large Kashmir Stag Head (*Cervus cashmirianus*) (*with text-block*). By C. Gilbert Rogers 1038

II. Porcupine's method of attack. By C. R. S. Pitman 1039

III. Porcupine's method of attack. By Randolph C. Morris 1040

IV. Caracal (*Felis caracal*) and Hunting Leopard (*Cynœlurus jubatus*) in Mirzapur, U. P. By G. O. Allen, I.C.S. 1041

V. Field Rats in the Deccan in 1879. By J. Davidson 1042

VI. Note on the eggs of *Prinia inornata*. The Indian Wren-Warbler. By F. Field 1043

VII. Note on the Nightjar (*Caprimulgus ægypticus*). By Major W. M. Logan Home.......... 1043

VIII. Strange behaviour of a wild bird. By Major J. E. M. Boyd 1043

IX. The Blue-breasted Quail (*Excalfactoria chinensis*) at Mirzapur. By H. Whistler, F.Z.S., M.B.O.U. 1044

X. Birds of different species nesting in Company. By G. O. Allen, I.C.S. 1044

PAGE

XI. The Red Turtle Dove (*Œnopepelia t. tranquebarica*) in Unao, U. P. By G. O. Allen, I.C.S. 1044

XII. Accidents to Vultures. By G. O. Allen, I.C.S. 1045

XIII. Howering habit of the Spotted Owlet (*Athene brahma*). By G. O. Allen, I.C.S. 1045

XIV. A 17 Scale Krait (*Bungarus cœruleus*) from Bangalore. By Lt.-Col. F. Wall, I.M.S.... 1046

XV. Early occurrence of the Painted Lady (*Vanessa cardui*, L.) in the Darbhanga District, Behar. By Chas. M. Inglis...... 1046

XVI. A curious method of feeding noted in *Danais limniace*, Cram. By T. V. Subrahmanian. 1047

XVII. Notes from the Oriental Sporting Magazine, June 1828 to June 1833. By Lt.-Col. R. W. Burton, I.A. 1047

XVIII. An Anomaly in Floral Biology. By S. P. Jivanna Rao, M.A. 1049

ACCOUNTS FOR 1918.......... 1051

PROCEEDINGS 1053

ALPHABETICAL LIST OF CONTRIBUTORS.

VOLUME XXVI.

PAGE

ACCOUNTS FOR 1918. 1051

ACWORTH, E. C. B. ; A Flight of Locusts (*With a Plate*) .. 301

AJREKAR, B. A. ; On the Identity of *Blastospora butleri* Syd. (*With a Plate*) 697

ALLAN, C. W. ; Life History of the *Antheræa roylei* (Oak Emperor Moth) 300

ALLEN, G. O., I.C.S. ; Natural Death of a Fox (*Vulpes bengalensis*) 660

——————— ; Occurrence of *Colotis vestalis* and *amata* at Unao. 868

——————— ; Naini Tal Butterfly Notes .. 870

——————— ; The Malabar Pied Hornbill (*Anthracoceros coronatus*) in Mirzapur, U. P. 671

——————— ; The Cuckoo (*Cuculus canorus*) in Mirzapur, U. P. 671

——————— ; Habits of the Painted Sandgrouse (*Pterocles fasciatus*) .. 672

——————— ; The Great Indian Bustard (*Eupodotis edwardsi*) in Mirzapur District, U. P. 673

——————— ; Habits of Ethar Worms 879

PAGE

ALLEN, G. O., I.C.S : The Habits of the Tree Frog (*Racophorus maculatus*) .. 681

——————— : Some Butterflies taken in Benares and adjoining Districts .. 689

——————— ; Tenacity of Life of *Parapelybia orientalis* 693

——————— ; Protective Habits of the Larva of *Trypanophora semihyalina* .. 693

——————— ; A few additions to the list of Mussoorie Plants, By JAMES MARTIN in Vol. XIX, p. 475. 695

——————— ; Caracal (*Felis caracal*) and Hunting Leopard (*Cynælurus jubatus*) in Mirzapur, U. P. 1041

——————— ; Birds of Different Species Nesting in Company 1044

——————— ; The Red Turtle-Dove (*Œnopepelia t. tranquebarica*) in Unao, U. P. 1044

——————— ; Accidents to Vultures 1045

——————— ; Hovering Habit of the Spotted Owlet (*Athene brahma*) .. 1045

Page

Ayyar, T. V. Ramakrishna, B.A., F.E.S., F.Z.S. ; Some South Indian Coccids of Economic Importance. (*With 4 Plates*) 621

Bagnall, Major R. ; Large Carp from Mesopotamia .. 679

Baker, E. C. Stuart, F.L.S., F.Z.S., M.B.O.U ; The Game Birds of India, Burma and Ceylon. Part XXV. (*With a Coloured Plate*). The Cheer Pheasant, The Fire-Back, The Siam Fire-Back .. 1

——— ; Part XXVI (*With a Coloured Plate.*) The Monal Pheasant, The Impeyan Pheasant or Monal, Sclater's Monal, *Lophophorus l'huysii* .. 319

——— ; Sub-Species and the Field Naturalist 518

——— ; Part XXVII. The Crimson-Horned Pheasant 705

——— ; Part XXVIII. (*With a Coloured Plate*). The Grey-Bellied Horned Pheasant, the Western Tragopan, the Tibetan Tragopan, Temminck's Tragopan, Cabot's Tragopan 885

Beeson, C. F. C., M.A., I.F.S.; Nesting Habits of *Vespa dorylloides*, Saus. 301

Bell, T. R., I.F.S. ; The Common Butterflies of the Plains of India. Part XXI .. 98

Page

Bell, T. R., C.I.E., I.F.S. ; The Commom Butterflies of the Plains of India. Part XXII. (*With Plate H.*) .. 438

——— ; Part XXIII 750

——— ; Part XXIV 941

Berthon, Lt.-Col. H. W. ; Occurrence of the Common Sheldrake (*Tadorna cornuta*) and the Marbled Duck (*Marmaronetta angustriostris*) in Kathiawar 674

Betham, Brig.-General R. M. ; The White-Cheeked Bulbul (*Molpastes leucogenys*) .. 286

Blandy, Capt. R. ; The Breeding habits of Mrs. Hume's Pheasant 289

——— ; Notes on Kalij Pheasants in the Chin Hills 289

Blatter, Rev. E., S.J. ; The Edible Date Palm in Bombay 306

Blatter, E., S.J. and Hallberg, Prof F. ; A Revision of the Indian Species of *Rotala* and *Ammannia*. Part II 210

——— ; The Flora of the Indian Desert (Jodhpur and Jaisalmer). Part I. (*With 12 Plates.*) 218

——— ; Part II. (*With 13 Plates.*). 525

——— ; Part III. (*With 6 Plates*).. 811

——— ; Part IV 968

Page

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA; Summary of the Results. By R. C. WROUGHTON. Part II 19

———————; Summary of the Results. By R. C. WROUGHTON, F.Z.S. Part III 338

———————; Summary of the Results. By R. C. WROUGHTON. Part IV. 776

———————; Summary of the Results. By R. C. WROUGHTON. Part V 955

———————; Scientific Results, No. XVIII. By MARTIN A. C. HINTON 59

———————; Scientific Results, No. XVIII. By MARTIN A. C. HINTON. Part II 384

———————; Scientific Results, No. XVIII. By MARTIN A. C. HINTON. Part III 716

———————; Scientific Results, No. XVIII. By MARTIN A. C. HINTON 906

———————; Scientific Results, No. XIX. By OLDFIELD THOMAS, F.R.S. 417

———————; Scientific Results No. XX. By OLDFIELD THOMAS, F.R.S. 726

Page

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA; Scientific Results, No. XXI. By OLDFIELD THOMAS, F.R.S. 933

BOULENGER, G. A., F.R.S., D.Sc.; Description of a New Snake of the Genus *Contia*, B. & G., from Persia .. 1024

BOYD, Maj. J. E. M.; Strange behaviour of a Wild Bird .. 1043

BRANDER, A. A. DUNBAR, I.F.S.; The Tiger and the Train 658

BREITHAUPT, A. G. H.; Ants attacking Bees 878

BROOKING, Major-General H. T.; List of Birds observed in the Euphrates Valley .. 677

BURTON, Brig.-General H. G.; Panthers 266

BURTON, Lt.-Col. R. W., I.A; Notes from the Oriental Sporting Magazine. New Series, 1869 to 1879 .. 309

———————; June 1828 to June 1833 .. 1047

CAINS, J. F., S.J.; The Habits of the Green Whip Snake (*Dryophis mycterizans*) .. 862

CLAYTON, F.; Mimicry in Spiders 302

COLVIN, Lt.-Col. E. J. D.; Notes on the habits of the Mallard (*Anas boscas*) .. 291

CONNOR, Lt.-Col. F. POWELL., I.M.S.; A Note on the function of the "Forceps" in *Forficulidæ* 688

Page

Connor, Lt.-Col. F. Powell, I.M.S.; Notes on the Emergence from the Cocoon in *Lasiocampidæ* 691

Cumming, W. D.; Natural History Notes from Fao .. 292

Currie, A. J.; Occurrence of Indian Red-breasted Fly catcher (*Siphia hyperythra*) in the Deccan 667

Davison, J.; Field Rats in the Deccan in 1879 1042

Dawson, H.; Extension of Range of the Bronze-winged Dove 672

Donald, C. H., F.Z.S.; The Birds of Prey of the Punjab. Part I. (*With 2 Diagrams*). 247

———— : Part II. (*With Plates I and II*) 629

———— : Part III. (*With Plate I.*) .. 826

———— : (*With Text-figures*) Part IV. 1000

———— ; Some Birds of Prey of Mesopotamia 845

Davison, Winifred M.; *See* Bombay Natural History Society's Mammal Survey of India.

Dracott, C. H.; Notes on the Flying White Ant and Scorpions that feed on them .. 873

Duke, J. A.; Tigress (*Felis tigris*) attacking a Sloth Bear (*Melursus ursinus*) .. 659

Duke, J. A.; Spotted Deer (*Axis axis*) and the Wild Dogs (*Cuon dukhunensis*) .. 661

Page

Ellis, E. V., I.F.S., Hannyngton, F., I.C.S.; Obituary Notices 1037

Evans, Lt.-Col. W. H., F.Z.S., F.E.S.; Notes on Indian Butterflies 1021

Field, F. (Reed); Note on the Eggs of *Prinia inornata*. The Indian Wren-Warbler .. 1043

Fraser, Maj. F. C., I.M.S.: Indian Dragonflies. Part III. (*With 12 Text-Figures*). 141

———— : Part IV. (*With 14 Text-Figures*) 488

———— : Part V. (*With Text-figures*). 734

———— : The Undescribed Female of an Indian Dragonfly (*Hemicordulia asiatica*) 685

———— : Part VI. (*With Text-figures*) 919

———— : Notes on some new and other Indian Dragonflies .. 874

Gosse, Capt. Philip, R.A.M.C.: Nilgiri Trap for catching Wild Animals 311

Hamilton, Lt.-Col. R. E. A.: The Beatrix or Arabian Oryx (*Oryx leucoryx*) in Central Arabia. (*With a Plate*).. 283

Hannyngton, F., I.C.S.: Life History Notes on Coorg Butterflies 871

Hannyngton, F., I.C.S., Ellis, E. W., I.F.S.; Obituary Notice 1037

Page

Heath, Reginald H.; Porcupine's mode of attack .. 282

Hide, Percy; Late stay of Common Snipe (*Gallinago cœlestis*) in Central India .. 849

Higgins, J. C., I.C.S.; The Sheldrake (*Tadorna cornuta*) in Manipur State 675

Hinton, Martin A. C.; *See* Bombay Natural History Society's Mammal Survey of India.

Home, Maj. W. M. Logan; Note on the Nightjar (*Caprimulgus ægypticus*) 1043

Hopwood, Cyril, M.B.O.U.; Notes on some Nests recently found in South Tenasserim 853

Hotson, Capt. J. E. B., I.A.R.O.; Oleander poisoning Camels 306

Hunt, E. A.; Note on the supposed effects of the bite of a Pentamomid Bug (*Halys dentatus*) 694

Jackson, Mrs. V. A.; Notes on a Young Hog Badger (*Arctonyx* sp.) in the Garo Hills. 281

———;

Further Notes on the Hog Badger 281

———;

Panic among Elephants during an Earthquake .. 285

Inglis, Chas. M., M.B.O.U.; The Burmese Peafowl (*Pavo muticus*) in the Chittagong Hill Tracts, Bengal .. 673

Page

Inglis, Chas. M., M.B.O.U.; Nidification of Stone's Pheasant (*Phasianus elegans*). A Correction 673

———;

Extracts from "A Monograph of the Phesants by William Beebe" 847

———;

The Black-Breasted Kalij Pheasant (*Gennæus horsfieldi horsfieldi*) east of the Irravaddy 848

———;

Further occurrence of the Rose-coloured Starling (*Pastor roseus*) and the Flamingo (*Phœnicopterus roseus*) in the Darbhanga District, Behar .. 853

———;

Early appearance of *Pieris brassicæ* (Linn.) in the Darbhanga District, Behar .. 869

———;

Harpactor costalis, Stal., preying on *Ceratina viridissima*, D. T. 872

———;

Early occurrence of the Painted Lady (*Vanessa cardui* L.) in the Darbhanga District, Behar 1046

———;

Travers, W. L., O'Donel, H. V. O. and Shebbeare, E. O., I.F.S.; A Tentative List of the Vertebrates of the Jalpaiguri District, Bengal. (*With Plates*) .. 819

———;

Part II. (*With a Plate, Map and Text-Block*) 988

PAGE

Jones, A. E.; A List of Birds found in the Simla Hills, 1908-1918 601
———; Further Notes on the Birds of Amballa District, Punjab 675
Jourdain, F. C. R.; Mesopotamian Bird Notes 860
Kenny, E. T.; Migration of Snipe in Burma 850
Kinloch, Lt. A. P.: Record Female, Nilgiri Tahr (*Hemitragus hylocrius*) 666
Kinloch, A. M.; The Cotton Teal in Malabar 674
———; The Habits of the Green Whip Snake (*Dryophis mycterizans*) .. 681
Kinnear, N. B., C.M.Z.S.; Note on the Malabar Slender Loris (*Loris lydekkerianus*) .. 836
———; Extension of Range of the Green Imperial Pigeon (*Carpophaga æna æna*) in Western India 846
———; The Giant Tortoise living in Ceylon. (*With a Plate.*). 861
Kyrle, Fellowes; Occurrence of the Lesser Florican or Likh *S. aurita* in the Mahableshwar Hills 289
Light, Lt.-Col. R.; Size of Tigers 659
———; Porcupine's method of shedding quills when attacked .. 666
Luard, Lt.-Col. C. E.; A Variety of *Butea frondosa* .. 305

PAGE

McCann, C.; On the breeding habits of some *Myriapoda* .. 303
Mackay, Brig.-General H., R. A.; Large Carp from Mesopotamia 680
Mackenzie, J. M. D., I.F.S., M.B.O.U., F.Z.S.; Nidification of the Smaller Streaked Spider-hunter (*Arachnothera aurata*) 669
Macnaghten, H.; On White Elephants 285
Magrath, Lt.-Col. H. A. F.; Sandgrouse in Mesopotamia. 672
Marryat, N.; Note on the occurrence of the Lesser Florican or Likh (*Sypheotis aurita*) in Bombay 674
Martin, S. J.; A Note on the large Brown Thrush (*Zoothera monticola*) 668
Mathews, W. H., I.P.; Note on the Indian Long-Billed Vulture (*Gyps indicus*) .. 287
———; Nesting habits of the Brown Rock-Chat (*Cercomela fusca*). 843
———; Albino Swallow 844
———; Different Birds nesting in company 853
Meredith, H. R.; Feeding habits of the Little Egret (*Herodias garzetta*) 852
Mills, J. P., I.C.S.; Notes on a Takin Head from Assam .. 284

PAGE

MITCHELL, F. J.; Method of Porcupine's attack 283

—— ; How Trouts were introduced into Kashmir 295

MONTEATH, G., B.A., I.C.S.; Tiger (*Felis tigris*) climbing tree 837

MORRIS, RANDOLPH C.; Porcupine's method of attack .. 1040

O'BRIEN, Lt.-Col. E.: Method of Porcupine's attack .. 283

—— ; Mongoose (*Mungos mungo*) killing a Hedgehog 660

—— ; Indian Grey Shrike (*Lanius lahtora*) attacking wounded Sand-Grouse 667

OLLENBACH, O. C.: Occurrence of *Stichopthalma godfreyi*, Roths 867

—— ; Notes on the habits of Butterflies (*Leuxidia masoni*) and (*Xanthotænnia busiris*) 869

OLIVER, Major D. G.: Spot-Bill Duck in Kashmir .. 675

OSMASTON, B. B., C.I.E., I.F.S.: Supplementary Notes on Some Indian Birds 424

PITMAN, C. R. S.; Porcupine's method of attack 1039

PRATER, S. H.; Notes on Some Interesting Snakes recently presented to this Society .. 683

PROGRESS OF THE MAMMAL SURVEY 656

—— 1036

PAGE

PROCEEDINGS 313-318

—— 698-703

—— 882

—— 1053

PUAR, H.H. UDAJI RAO., K.C.S.I., K.B.E., Maharaja of Dhar; Notes on the Big Game and Duck of Dhar State .. 841

RAO, S. P. JIVANA, M.A.: An Anomaly in Floral Biology .. 1049

REPORTS: BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON, No. 30, Deccan (Poona District), and 31, Nilgiris 1025

REVIEW: A practical handbook of British Birds 880

RIDLAND, J. G.; Arrow head imbedded in a Tiger's back. 658

RISHWORTH, H. R.; Libellulines at St. Thomas' Mount, Madras 685

ROBINSON, S. M.; Maternal instinct in the Pied Bush-Chat (*Pratincola caprata*) .. 843

RODGERS, C. GILBERT; Large Kashmir Stag Head (*Cervus cashmirianus*) (*With text-block*) 1038

SCOTT, Capt. F. B., I.A.; Notes on the Larva of *Chærocampa alecto* 299

—— ; The Hawk Moth (*Deilephilia livornica*). A correction .. 872

PAGE

SEDGWICK, L. J., I.C.S.; *Eleocharis congesta*, Don., in the Bombay Presidency .. 312

——— ; Reduction of *Euphorbia rothiana* 599

——— ; The Cyperaceæ of the Bombay Presidency. Part II .. 192

SLATER, A. F. M.; Late stay of Pin-tail Snipe (*Gallinago stenura*) in Burma 850

SMITH, MALCOLM A., F.Z.S.; Remarks on Col. Wall's identification of *Hydrophis cyanocinctus* 682

SUBRAHMANIAM, T. V.; A curious method of feeding noted in *Danais limniace*, Cram 1047

TADULINGAM, C., and RANGACHARI, K.; Note on a new undescribed species of *Cynodon*. (*With a Plate*) .. 304

THOMAS, OLDFIELD, F.R.S., F.Z.S.; Scientific Results from the Mammal Survey, No. XIX. A Synopsis of the Groups of True Mice found within the Indian Empire 417

——— ; A New Species of *Nesokia* from Mesopotamia 422

——— ; Some new Mammals from Mesopotamia 745

——— ; *See* BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA.

PAGE

TICEHURST, Capt. CLAUDE B., R.A.M.C.; The Mesopotamian Bulbul 279

——— ; The Plumage of the Purple Honeysucker (*Arachnecthra asiatica*) 286

——— ; The colour of the eye of the female White-Eyed Pochard (*Nyroca africana*) 290

——— ; On Asiatic Starlings .. 380

WALL, Lt.-Col. F., C.M.G., C.M.Z.S., F.L.S., I.M.S.; A Popular Treatise on the Common Indian Snakes. Part XXVI. (*With Plate XXVI and Diagram of Cerberus rhyncops and Enhydris curtus* 89

——— ; Part XXVII. (*With Plate XXVII and Diagram of Hydrophis spiralis and Hydrophis cyanocinctus.*) 430

——— ; Part XXVIII. (*With a coloured Plate XXVIII and Diagram of Enhydrina valakadien and Hydrus platurus* var. *bicolor* 803

——— ; Notes on a Collection of Snakes made in the Nilgiri Hills and the Adjacent Wynaad. (*With Diagrams and Maps.*) *Typhlops thurstoni, Typhlops fletcheri, Melanophidium wynadense, Rhinophis sanguineus, Silybura brevis and Rhabdops olivaceus*) .. 552

PAGE

WALL, Lt.-Col. F., C.M.G., C.M.Z.S., F.L.S., I.M.S.; The rudimentary hind limb in an Embryo of *Python molurus* 862

———; Note on the Snake *Trirhinopholis nuchalis* (Boulenger) .. 863

———; A Gravid Specimen of the Snake *Cylindrophis maculatus* (Linn.) 863

———; Reply to Dr. Malcolm Smith's remarks in the last Journal 864

———; Notes on some recent additions to our Society's Snake collection 865

———; A 17 Scale Krait (*Bungarus cæruleus*) from Bangalore .. 1046

WARD, F. KINGDON; Distribution of the different races and species of Takin (*Budorcas*) 838

WARE, F.; Wild Dogs (*Cuon dukhunensis*) and Sambhur .. 837

WHITE, L. S.; Nesting habits of the Brown Rockchat (*Cercomela fusca*) 667

WHISTLER, H., M.B.O.U., F.Z.S.; Notes on the Birds of Ambala District, Punjab. Part II 172

PAGE

WHISTLER, H., M.B.O.U., F.Z.S.; The Common Hawk-Cuckoo (*Hierococcyx varius*) in the Punjab 287

———; Abnormal varieties of the Indian Redstart (*R. rufiventris*) and the Common House Crow (*C. splendens*) 289

———; Some Birds of Ludhiana District, Punjab 585

———; Some Birds observed at Fagoo near Simla 770

———; Variety of the Common House Crow (*Corvus splendens*) at Jhang, Punjab .. 843

———; Abnormal variety of the Green Bee-eater (*Merops viridis*) 844

———; A Note on the breeding of the Hill Partridge (*Arboricola torqueola*) near Simla .. 849

———; The Blue-breasted Quail (*Excalfactoria chinensis*) at Mirzapur 1044

WRIGHT, A.; The Bite of the Large Spotted Viper (*Lachechis monticola*) 681

WROUGHTON, R. C., F.Z.S.; *See* BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA.

MARINE BIOLOGICAL LABORATORY
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LIST OF PLATES.

VOLUME XXVI.

No. 1.

PAGE

The Game Birds of India, Burma and Ceylon. The Cheer Pheasant (*Catreus wallichii*) 1

A Popular Treatise on the Common Indian Snakes, Plate. XXVI.—
Figs. 1—4. The Dog-faced Water Snake (*Cerberus rhynchops*). 90
5—8. Shaw's Sea-snake (*Enhydris curtus*).

The Flora of Indian Desert (Jodhpur and Jaisalmer). Part 1. With 12 Plates—

Plate I (A)—Wind erosion in sand-dune near Loharki, Jaisalmer State 218
(B)—Wind erosion in lime-stone, 3 miles S. W. of Phalodi, Jodhpur State 218

Plate II (A)—Sand-dune with scanty vegetation at Loharki, Jaisalmer State 219
(B)—Part of sand-dune devoid of vegetation, showing ripples. In the background the plain near Loharki. 219

Plate III (A)—Jodhpur City and neighbouring hills as seen from the Fort 222
(B)—View of Jaisalmer Town and surrounding plain, taken at the Guest House 222

Plate IV (A)—A typical gravel-plant: *Seetzenia orientalis*, Dcne, in flower and fruit 223
(B)—Another member of the gravel-vegetation: *Corchorus antichorus*, Raeuseh, forming dense mats lying flat on the ground 223

Plate V (A)—Kailana Lake near Jodhpur. Rocky shore with *Euphorbia* vegetation 224
(B)—Kailana Lake Dam exhibiting a varied vegetation owing to the percolation of water: *Calotropis procera*, *Ærua tomentosa* and numerous high grasses. 224

PAGE

Plate VI (A)—General view of country near Mandor (Jodhpur State). In the foreground a rocky plateau with *Euphorbia neriifolia*, L. In the sandy plain between the plateau and the lake : *Crotalaria burhia*, *Leptadenia spartium*, *Ærua sp.* 225
(B)—Plain near Jodhpur, showing small trees and scrub vegetation : *Leptadenia spartium*, *Prosopis spicigera*, *Acacia arabica*, *Ærua tomentosa*, etc. 225

Plate VII (A)—Sandy plain 3 miles E. N. E. of Jaisalmer Town. In the foreground fruiting specimens of *Citrullus colocynthis*, with shoots up to 50 ft. long 228
(B)—A consocies of *Indigofera argentea*, Burm. On a sand-dune, 3 miles S. W. of Phalodi (Jodhpur State) 228

Plate VIII (A)—A depression in rocky country, 6 miles N. E. of Jaisalmer Town, with *Prosopis spicigera*, *Salvadora oleoides*, *Gymnosporia montana*. In the foreground : *Commiphora mukul*, *Sarcostemma brevistigma* .. 229
(B)—Shoot-habit of *Commiphora mukul* on rocky slope of the above locality 229

Plate IX (A)—A giant specimen of *Capparis decidua* at Bhikamkor (Jodhpur State) 230
(B)—A characteristic community of plants at Bhikamkor : *Gymnosporia montana*, *Prosopis spicigera*, and rambling on these : *Calligonum poligonoides* and *Cocculus*. 230

Plate X (A)—Consocies of *Eclipta erecta* bordering a drying-up pool at Barmer (Jodhpur State) 231
(B)—Families in the consocies of *Eclipta erecta* at Barmer, showing distinct zonation 231

Plate XI (A)—The Bada Bag in the neighbourhood of Jaisalmer Town 234
(B)—The tank belonging to the above Garden shaded by *Acacia arabica* 234

Plate XII (A)—Gharsisar Lake outside Jaisalmer Town. The water level is abnormally high on account of the heavy rains of 1917. In the foreground : *Capparis decidua*, *Prosopis spicigera*, *Salvadora oleoides*, *Zizyphus* .. 235
(B)—Amarsagar Lake near Jaisalmer Town, irrigating the garden of the same name. Chief trees : *Azadirachta indica*, *Zizyphus jujuba*, *Acacia arabica*, *Prosopis spicigera*, *Albizzia* 235

PAGE

The Beatrix or Arabian Oryx (*Oryx beatrix*) in Central Arabia .. 283

A Flight of Locusts at Poona—1903 301

Note on a New Undescribed Species of Cynodon (*Cynodon intermedius*) 305

No. 2.

The Game Birds of India, Burma and Ceylon. The Monal Pheasant (*Lophophorus refulgens*) 319

Monal Pheasants—

Lophophorus impejanus, *Lophophorus sclateri*, *Lophophorus L'huysii*— 335

Fig. 1. Heads showing variation in crest.
2. Single feathers of crest.
3. Tails and upper tail-coverts.

A Popular Treatise on the Common Indian Snakes. Part XXVII. With coloured Plate XXVII and Diagram 430

1—4. The Narrow-ringed Sea-snake (*Hydrophis spiralis*, var. *brugmansii*).
5—8. The Chittul (*Hydrophis cyanocinctus*).

The Common Butterflies of the Plains of India. Part XXII. With Plate H 438

Figs. 53, 53*a*—*Taguria cippus* ♂, ♀
54, 54*a*—*Virachola isocrates* ♂, ♀
55 —*Loxura atymnus* ♂
56, 56*a*—*Curetis thetis* ♂, ♀
57, 57*a*—*Arhopala centaurus*, ♂, ♀ 438

The Flora of the Indian Desert, Jodhpur and Jaisalmer. With Plates from XIII—XXV—

Plate XIII (A)—Crest of a dune East of Loharki (Jaisalmer State). On top: *Calligonum polygonoides*. On the slope: *Rhynchosia arenaria*, *Ærua pseudo-tomentosa*, *Indigofera argentea* 526

(B)—The same dune as above, seen from the plain. Part of the advancing wind-eroded crest is shown on Plate I.-A. 526

Plate XIV (A)—View of gravel plain from the top of dune in Plate XIII showing bare patches. In the foreground, at foot of dune: *Ærua tomentosa*, *Crotalaria burhia* 528

(B)—Bare area in the above locality, colonized by *Cleome papillosa*, *Fagonia cretica*, *Boerhaavia diffusa*, and *Leptadenia spartium* 528

		Page
Plate XV	(A)—Edge of sand-dune at Loharki, Jaisalmer State, (the same as on Plate II) with a clump of *Calotropis procera, Ærua tomentosa, Leptadenia spartium* and *Panicum turgidum*	530
	(B)—Elevated dune area at Loharki, with *Crotalaria burhia, Leptadenia spartium, Ærua pseudo-tomentosa* and *Panicum turgidum*	530
Plate XVI	(A)—In the neighbourhood of Kailana (Jodhpur State). A clump of *Leptadenia spartium* and *Ærua tomentosa*	532
	(B)—Near Kailana; *Leptadenia spartium* supporting *Launæa chondrilloides*	532
Plate XVII	(A)—Along the road from Jodhpur to Balsamand: *Crotolaria burhia* and *Ærua tomentosa* with isolated individuals of *Calotropis procera;* in the back-ground *Prosopis spicigera*	534
	(B)—On the road between Jodhpur and Kailana: *Crotalaria burhia, Ærua tomentosa* and *Leptadenia spartium*	534
Plate XVIII	(A)—Clump of *Lycium barbarum* and *Capparis decidua* in a sandy plain near Devikot (Jaisalmer State).	536
	(B)—Shoot-habit of *Haloxylon salicornicum.* The plant protects the small mound on which it grows against erosion. Taken East of Sodakoer (Jaisalmer State)	536
Plate XIX	(A)—A rocky plain with little soil at Amarshgar near Jaisalmer. In the background *Euphorbia neriifolia*	538
	(B)—A family of *Aristida hirtigluma* on volcanic ground, West of Loharki (Jaisalmer State) ..	538
Plate XX	(A)—Dune vegetation at Osian (Jodhpur State) ..	540
	(B)—Another view from the above dune area ..	540
Plate XXI	(A)—Near Kailana Lake. A specimen of *Euphorbia neriifolia,* supporting *Sarcostemma brevistigma.*	542
	(B)—On the rocky plateau above Mandor near Jodhpur. A clump of *Euphorbia neriifolia, Capparis decidua,* and *Convolvulus glomeratus,* var. *volubilis.* The low vegetation consisting chiefly of *Aristida*	542

PAGE

Plate XXII (A)—A sandy plain at Sodakoer village (Jaisalmer State). An association of *Ærua tomentosa* and *Ærua pseudo-tomentosa,* with families of *Capparis decidua* 544

(B)—*Cistanche tubulosa,* parasitic on the roots of *Capparis decidua* in the above locality .. 544

Plate XXIII (A)—An open forest of *Zizyphus rotundifolia* between Loharki and Sodakoer (Jaisalmer State). In the foreground a bare gravel area and an isolated specimen of *Prosopis spicigera* .. 546

(B)—Rocky river bank, two miles East of Sodakoer, with *Schweinfurthia hærocarpa* and *Anticharis linearis* 546

Plate XXIV (A)—Sand dune north of Jaisalmer. On the right a family of *Cyperus arenarius,* to the left *Ærua sp.,* on the hill in the background *Fagonia cretica* 548

(B)—Pond and marshy ground between Phalodi and Bap with various *Cyperaceæ* 548

Plate XXV (A)—Western slope of a sand-dune three miles south-west of Phalodi (Jodhpur State), with pure *Calotropis procera* association 550

(B) Family of *Cyperus arenarius* covering the eastern slope of the above dune 550

Some South Indian Coccids of Economic Importance—

Plate I.—*Pulvinaria maxima.* 624

(A)—Scale infested branch of Nim.

(B)—1 ♀ adult. 2t. ♂ Puparium. 3. ♀ with ovisac.

Plate II.—*Phenacoccus insolitus.* 626

(A)—Brinjal plant covered with ovisacs.

(B)—A ♂ mealy bug with ovisac magnified.

(C)—The larva.

Plate III—*Anomalococcus indicus* (nov. sp.) 627

(A)—Babul branch infested with scales and visited by the black ant.

(B)—Female and male puparia magnified, two views of the former are shown.

PAGE

Plate IV—*Walkeriana cineari* 628
(A)—Adult scales on Portia stem X1.
(B)—Adult ♀.
(C)—Adult ♀.
(D)—Larva.
(E)—Very young larva.

The Birds of Prey of the Punjab. (With 2 Plates)—
Plate I.—Figs. 1 and 2 represent a bird flying directly overhead .. 632
Plate II—Figs. 1, 2 and 3. All represent a bird flying directly overhead 650

On the identity of *Blastospora butleri* 696

No. 3.

A Popular Treatise on the Common Indian Snakes—
Plate XXVIII—1—5. The Jew's-nosed snake (*Enhydrina valakadien*). 803
6—8. Linne's Seasnake (*Hydrus platurus*).

The Flora of the Indian Desert (Jodhpur and Jaisalmer). With 6 Plates. XXVI—XXXI—
Plate XXVI (A)—View of Phalodi (Jodhpur State), taken from the Rest House 811
(B)—View of Barmer (Jodhpur State) and neighbouring hills 811
Plate XXVII (A)—A rocky valley above Mandor (Jodhpur State). On the terraced slope: *Euphorbia neriifolia*. In the foreground: a belt of *Ærua tomentosa*, below it *Lepidagathis trinervis* and *Fagonia cretica* 812
(B) A field at Balarwa (Jodhpur State), invaded by *Leucas aspera* 812
Plate XXVIII (A)—Gravel vegetation near Balarwar (Jodhpur State). Sand-binding plants in the foreground; in the background *Capparis decidua*, *Prosopis spicigera* 814
(B)—Scrub at Bhikamkor (Jodhpur State). *Capparis decidua*, *Gymnosporia montana*, *Lycium barbarum*, *Zizyphus rotundifolia*, *Prosopis spicigera*, *Calligonum polygonoides*, *Crotalaria burhia*, *Tephrosia purpurea*, *Ærua* sp. 814
Plate XXIX (A)—Chatris near Mandor (Jodhpur State). On the rocky ground: *Euphorbia neriifolia* 816
(B)—The Bada Bag dam near Jaisalmer. To the right: *Acacia arabica* 816

PAGE

Plate XXX (A)—Dry gravelly river-bed 2 miles East of Sodakoer (Jaisalmer State). Shrubs in the foreground: *Haloxylon salicornicum.* Trees in the background *Rordia rothii* surrounded by a belt of *Calotropis procera* 817

(B)—Locality as above *Haloxylon salicornicum, Cordia rothii* and grasses 817

Plate XXXI (A)—Hill near Marwar-Lohawat (Jodhpur State). To the left a low sand-dune with *Calligonum polygonoides*, in the foreground *Crotalaria burhia, Convolvulus sp.*, and various grasses 818

(B) Typical Fort at Devikot (Jaisalmer State). Scanty ruderal vegetation 818

A Tentative List of the Vertebrates of the Jalpaiguri District, Bengal. (*With a Plate*).

Plate I.—(*a*) Tea with shade trees haunts of *Franklinia gracilis* and other Warblers 820

(*b*) Torsa river, the haunt of *Ardea insignis, Merganser castor*, etc.; the stones in the foreground affording shelter to the Wall Bat (*Myotis muricola*) 820

The Birds of Prey of the Punjab 825

Plate I.—Fig. 1.—Represents a Buzzard flying directly overhead.

2.—Represents a Kite flying directly overhead.

3.—Represents a Black-winged Kite flying directly overhead.

The Giant Tortoise (*Testudo gigantea*) living in Hirumbard, Galle, Ceylon 861

No. 4.

The Game Birds of India, Burma and Ceylon—

The Grey-bellied Horned Pheasant (*Tragopan blythi*) 885

A Tentative List of the Vertebrates of the Jalpaiguri District, Bengal. (With a Plate and Map of the Jalpaiguri District) 988

Plate II—1.—A stream rising in the hills, the jungle on the banks being the resort of *Pavo cristatus*, the Common Peafowl, *Gallus ferrugineus*, the Red Jungle-fowl, etc., and the sand and stones that of *Œdicnemus scolopax* the Stone-Curlew, and other waders 992

2.—Near view of forest along the banks of a river. Haunts of *Ketupa zeylonensis*, the Brown Fish-Owl, *Polioaëtus humilis*, Hodgson's Fishing Eagle, etc. 992

Index to Illustrations.

PAGE

Acacia arabica, Pl. 225, 234, 235, 816
Acisoma panorpoides panorpoides, Wing neuration of, Fig. 492
Ærna pseudo-tomentosa, Pl. .. 526, 530, 544
——— *tomentosa*, Pl. .. 224, 225, 528, 530, 532, 534, 554, 812
——— sp. Pl. .. 225, 538, 548, 814
Albizzia 235
Alcedo ispida, Haunts of, Fig. 997
Anomalococcus indicus, Gr. Pl. 627
Anticharis linearis, Pl. .. 546
Arabian Oryx, (*Oryx leucoryx*) Pl. 283
Arhopala centaurus, 57, 57*a*, Pl. 438
Arrow head imbeded in the Tiger's Back, Fig. 658
Ardea insignis, Toorsa River, the haunts of, Pl. 820
Aristida, Pl. 542
Azadirachta indica 235
Bada Bag in the neighbourhood of Jaisalmer Town, Pl. .. 234
Barmer, view of (Jodhpur State) 811
Birds of Prey of the Punjab. Part II. (*With Plates I and II*) 629
Birds of Prey of the Punjab. Part III. (*With Plate I*) .. 826
Black-winged Kite flying directly overhead, Fig. 3 826
Blastospora butleri, Syd. Pl. .. 696
Bœrhaavia diffusa, Pl. .. 528
Brachythemis contaminata, Wings showing neuration, Fig. 737

PAGE

Brachythemis farinosa, Male Sexual Organs of, Fig. (*a*) .. 490
——— Female Sexual Organs of, Fig. (*b*) .. 490
——— *sobrina*, Male Sexual Organs of, Fig. (*a*) 490
——— Female Sexual Organs of, Fig. (*b*) .. 490
——— Wing neuration of, Fig. .. 491
Bradinopyga geminata, Wings showing neuration, Fig. .. 514
Butterflies, Common—of the plains of India. Part XXII, Pl. H. 438
Buzzard flying directly overhead, Fig. 1 826
Calligonum polygonoides, Pl. 814, 818, 230, 526
Capparis decidua, Pl. .. 230, 235, 536, 542, 544, 814
Carp, Large from Mesopotamia, Fig. 679-680
Catreus wallichii, Pl. 1
Cerberus rhynchops, Pl. Fig. 1-4 90
Cervus cashmirianus, Fig. .. 1038
Cheer Pheasant, Pl. 1
Chithul, The (*Hydrophis cyanocinctus*) Pl. 436

PAGE

Cistanche tubulosa, Pl... .. 544
Citrullus colocynthus, Pl. .. 228
Cleome papillosa, Pl. 528
Coccids. Some South Indian of Economic Importance (*a*) .. 621
Cocculus, Pl. 230
Colotropis procera, Pl. .. 224, 530 534, 550, 817
Commiphora mukul, Pl. .. 229
Convolvulus glomeratus, var. *volubilis*, Pl. .. 542
——— sp. Pl. 818
Corchorus antichorus, Pl. . 223
Cordia rothii, Pl. 817
Cratilla metallica, Wing neuration of, Fig. 152
Crocothemis servilia, Wings of, Fig. 515
Crotalaria burhia, Pl. .. 225, 528, 530, 534, 814, 818
Curetis thetis, 56, 56*a*, Pl. .. 438
Cynodon intermedius, Pl. .. 305
Cyperaceæ, Pl. 538, 548
Cyperus arenarius, Pl. 538, 548, 550
Diplacodes nebulosa, Forewing of, Fig. (A).. 500
——— *trivialis*, Forewing contrasting its neuration with that of "A" Fig. (B).. 500
——— Hindwing of, Fig. (B).. 500
——— Male Sexual Organs of, Fig. 1. In profile 2. From the front .. 502
Dog-faced Water Snake (*Cerberus rynchops*) 90

PAGE

Dragonflies, Indian, Part III (*With* 12 *Text-figures*).. 141
——— Part IV (14 *Text-figures*).. 488
——— Part V (*With Text-figures*) .. 734
——— Part VI (*With Text-figures*) .. 919
Dune Vegetation at Osian, Pl. 540
Eclipta erecta, Pl. 231
Embryo, Rudimentary hind-limb in an, of *P. molurus* .. 862
Enhydris curtus, Pl. Fig. 5-8. 90
——— *valakadien*, Pl. 1—5. 803
——— *valakadyn*, Fig. (A—D.) 808
Euphorbia neriifolia, Pl. ..225, 542, 812, 816
——— vegetation, Pl. .. 224
Fagonia cretica, Pl. 528, 538, 548, 812
Falcon, tooth and festoon, Fig. 1006
Flora of the Indian Desert (Jodhpur and Jaisalmer), (Pl. I—XII).. 218
Flora of the Indian Desert (Jodhpur and Jaisalmer), Part II (*With* 13 *Plates*, XIII—XXV) 525
Flora of the Indian Desert (Jodhpur and Jaisalmer) Part III (*With* 6 *Plates*, XXVI—XXXI) 811
Forceps: A note on the function in *Forficulidæ*, Fig. .. 688
Forficulidæ: A note on the function of "Forceps" 688

PAGE

Fort, Typical at Davikot (Jaisalmer State) 818

Franklinia gracilis, Tea with shade trees haunts of, Pl. .. 820

Gallus ferrugineus, the jungle on the banks being the resort of, Pl. 992

Game Birds of India, Burma and Ceylon. Part XXV, Plate 1

Game Birds of India, Burma and Ceylon. Part XXVI, Plate 320

Game Birds of India, Burma and Ceylon. Part XXVIII, Plate 885

Giant Tortoise at Hirumbard, Galle, Pl. 861

Gymnosporia montana, Pl. 229, 230 814

Haloxilon salicornicum, Pl. .. 536, 817

Hydrophis spiralis. 1—4, Pl. .. 430

———— Fig. A, B, C and D ... 436

————*cyanocinctus*, Fig. A—E and F. .. 436

———— 5—8, Pl. 430

Hydrus platurus, Fig. (A—C) .. 808

———— var. *bicolor*, Pl. 6—8 .. 803

Impeyan Pheasant, Pl. .. 335

Indigopera argentea, Pl. 228, 526

Indothemis limbata, Wings showing neuration, Fig. .. 734

Jaisalmer town and surrounding plain B. 222

Jew's-nosed Snake, Pl. 1—5 .. 803

Jodhpur City and neighbouring hills, A. 222

Ketupa zeylonensis, Haunts of, Pl. 992

Kite, flying directly overhead, Fig. 2 826

PAGE

Lasiocampidæ, Note on emergence from the Cocoon, Fig. 692

Lathrecista asiatica, Wings of, Fig. .. 146

———— Male Sexual Organs of, Fig. 21. 148

———— Female Sexual Organs of, Fig. 22 .. 148

Launæa chondrilloides, Pl. .. 532

Lepidagothis trinervis, Pl. .. 812

Leptadenia spartium, Pl. .. 225, 528, 530, 532, 534

Leucas aspera, Pl. 812

Libellula quadrimaculata, Wings of, Fig. 149

Linne's Snake, Pl. 6—8 .. 803

Locusts, A flight at Poona, 1903, Pl. 301

Lophophorus impejanus, Pl. .. 335

———— *sclateri*, Pl. .. 335

———— *l'huysii*, Pl. .. 535

———— *refulgens*, Pl. .. 320

Loxura atymorus, 55, Pl. .. 438

Lycium barbarum, Pl. .. 536, 814

Lyriothemis acigastra, Male Sexual Organs of, Fig. (14) 141

———— *cleis*, Female Sexual Organs of, Fig. (15) .. 141

———— Male Sexual Organs of, Fig. (16) .. 141

———— *acigastra*, Wings of, Fig. (17) .. 142

———— *cleis*, Wings of, Fig. (18) .. 143

Map, migration of Snipe in Burma 851

PAGE

Map of the Jalpaiguri District 988
Map II, General scheme of mountain ranges 554
Melanophidium wynadense, Fig. (A., B.) 556
Merganser castor, Toorsa River, the haunts of, Pl. 820
Mesopotania, Large Carp, from, Fig. 679-680
Monal Pheasant, Pl. .. 320
Neurothemis intermedia, Wings contrasting the open and close reticulation of the neuration. Fig. (38) (*a*) .. 506
—— *fulvia*, Wings contrasting the open and close reticulation of the neuration. Fig. (*b*) .. 506
——, Sexual Organs of, Fig. (39).. 508
(*a*) of the male from the front, (*b*) of the male in profile, (*c*) of the female .. 508
—— *intermedia intermedia*, Sexual Organs of (*a*) of the male seen from the front, (*b*) of the male from the side, Fig. (40) .. 511
Œdicnemus scolopax, the sand and stones being the resort of, Pl. 992
Onychothemis tonkinensis ceylanica, Male Sexual Organs of, Fig. (*a*) 742
(*b*) claws of same contrasted with "C" which shows the claws of *Lygonyx iris*, furnished with claw hooks, Fig. (46). 742
—— *tonkinensis ceylanica*, Wings showing neuration. Fig. (47) .. 743
Orogomphus xanthoptera, sp. nov. Wings of, Fig. .. 875
—— *chrysostigma*, Male Genital Organs of, Fig. (25) (*a*).. 154
—— *ransonnetti*, Male Genital Organs of, Fig. (*b*) .. 154
—— *japonicum*, Male Genital Organs of, Fig. (*c*) .. 154
—— *sabina*, Male Genital Organs of, Fig. (*d*) .. . 154
—— *auceps*, Male Genital Organs of, Fig. (*e*) 154
—— *tæniolatum*, Male Genital Organs of, Fig. (*f*) .. 154
—— *brunneum brunneum*, Wings and Male Genital Organs of, Fig. (26) .. 159
—— *glaucum*, Female Genital Organs of, Fig. (27) (*a*). 165
—— *triangulare*, Female Genital Organs of, Fig. (*b*) .. 165

PAGE

Orogomphus pruinosum, Male Genital Organs of, Fig. (*c*) .. 165

———— *triangulare*, Male Genital Organs of, Fig. (*d*) .. 165

Orthetrum sabina, Wings of, Fig. (28) 167

Oryx, Arabian or Beatrix, Pl. 283

Oryx beatrix, Pl. 283

Palpopleura, Wing neuration of, Fig. 488

Panicum turgidum, Pl. .. 530

Pavo cristatus, the jungle on the banks being the resort of, Pl. 992

Pelargopsis gurial, Haunts of, Fig. 997

Phalodi (Jodhpur State), view of, Pl. 811

Pheasant, Grey-bellied Horned, Pl. 885

Pheasant, Monal, Pl. 320

Phenacoccus insolitus, Gr. Pl. .. 626

Plotus melanogaster, Haunts of, Fig. 997

Polioaëtus humilis, Haunts of, Pl. 992

Potomarcha, Wings of, Fig. .. 144

Prosopis spicigera, Pl. .. 225, 229, 230, 235, 534, 546, 814

Pulvinaria maxima, Gr. Pl. .. 624

Rhabdops olivaceus, Fig. (A—C.) 564

Rhinophis sanguineus, Fig. 556

————————, Fig. (A—C.). 564

Rhodothemis rufa, Wings showing neuration, Fig. 504

Rhynchosia arenaria, Pl. .. 526

River Toorsa, the haunts of *A. insignis* and *M. castor*, Pl. 820

PAGE

Ryothemis variegata, Wings of ♂. Fig. 928

———— ———— *variegata*, Wings of ♀. Fig. 931

———— *phyllis phyllis*, Sexual Organs of, Fig. 932

Salvadora oleoides, Pl. .. 229, 235

Sand-dune with scanty vegetation at Loharki, A. .. 219

Sand-dune devoid of vegetation, showing ripples, B. .. 219

Sarcostemma brevistigma, Pl. 229, 542

Schweinfurthia hærocarpa, Pl. 546

Sclater's Monal Pheasant, Pl. . 335

Sea-snake, The Narrow-ringed, Pl. 430

Seetzenia orientalis, Pl. .. 223

Shaw's Sea-snake 90

Silybura brevis, Fig. (A—E.) .. 558

Stag, Large Kashmir, Fig. .. 1038

Stichopthalma godfreyi, Roths, Fig. 868

Snakes, Common Indian (*Plates* XXVI, XXVII, XXVIII) 90, 430, 803

Snakes, Common Indian, Diagrams 96, 436, 808

Snakes, Notes on a collection made in the Nilgiri Hills and the adjacent Wynaad (*With Diagrams and Maps*) .. 552

Sympetrum, Wing neuration of, Fig. 494

———— *decoloratum*, Male Genital Organs of, Fig. (*a*) .. 496

———— *fonscolombei*, Male Genital Organs, Fig. (*b*) .. 496

PAGE

Sympetrum hypomelas, Male Genital Organs, Fig. (*c*) 496
——— *decoloratum*, Female Genital Organs, Fig. (*d*) 496
——— *commixtum*, Male Genital Organs, Fig. (*e*) 496
——— *orientale*, Male Genital Organs, Fig. (*f*) 496
——— *orientale*, Female Genital Organs, Fig. (*g*) .. 496
——— *hypomelas*, Female Genital Organs, Fig. (*h*) 496
Tajuria cippus, 53, 53*a*, Pl. .. 438
Tephrosia purpurea, Pl. .. 814
Testudo gigantea, at Hirumbard, Galle, Pl. 861
Tortoise, Giant at Hirumbard, Galle, Pl. 861
Tragopan blythi blythi, Pl. .. 885
Trap Nilgiri for catching wild animals, Fig. 311

PAGE

Trithemis festiva, Male Sexual Organs, Fig. (*a*) .. 919
——— *palidinervis*, Male Sexual Organs. Fig. (*b*) 919
——— *aurora*, Male Sexual Organs, Fig. (*c*) .. 919
——— *aurora*, Wings showing neuration, Fig . 921
——— *kirbyi*, Male Sexual Organs, Fig. (*d*) .. 919
Typhlops thurstoni, Fig. .. 556
——— *fletcheri*, Fig. .. 556
Vertebrates, A Tentative list of the Jalpaiguri District, Bengal. Part II (*With a Plate, Map and Text-block*) .. 988
Virachola isocrates, 54, 54*a*. Pl. 438
Wind erosion in sand dune near Loharki (A) 218
Wind erosion in lime-stone (B) 218
Walkeriana cineria, Gr. .. 620
Ziziphus rotundifolia, Pl. 814, 546
——— *jujuba* 235
———, Pl. 235
Zygonyx iris, Wings showing neuration, Fig. 740

ERRATA.

No. 1, VOLUME XXVI.

Page 80, plate XXVI, figures 5-6, *for* '*Enhydrina*' *read Enhydris.*
,, 294, line 21 from the bottom, *for* "the *macqueeni*" *read* "than *macqueeni.*"

No. 2, VOLUME XXVI.

Page 380, line 13 from the top, *for* "Linnans" *read* "Linnaeus".
,, ,, footnote, 3 lines from bottom, *for* "geren" *read* "green."
,, 570, lines 8 and 9 from top of text, *for* "94" *read* "91.'
,, 571, line 10 from top, *for* "242" *read* "252."
,, 583, under subcaudals of *Dipsadomorphus ceylonensis*, *for* "94 to 111" *read* "91 to 110."
,, 583, under ventrals of *Dipsadomorphus nuchalis*, *for* "248 to 266" *read* "233 to 252."
,, 583, under subcaudals of *Dipsadomorphus nuchalis*, *for* "113 to 129" *read* "90 to 111."
,, 594, No. 1310, *for* "*risovies*" *read* "*risorius.*"
,, 609, No. 704, *for* "*Zoothere*" *read* "*Zoothera.*"
,, 659, Title of Note No. IV, *for* "*Tigres*" *read* "*Tigris.*"
,, 666, Title of Miscellaneous Note No. X, *for* "*Hylocirius*" *read* "*Hylocrius.*"
,, 667, Footnote to Note No. XII, *for* "*Sephia*" *read* "*Siphia.*"
,, 668, Title of Note No. XIV, *for* "*Zoothea*" *read* "*Zoothera.*"
,, 672, line 2 from the bottom, *for* "are not probably" *read* "are rare but probably."
,, 673, ,, 15, *read* Baghownie *instead of* Baghowinie.
,, ,, ,, 16, ,, Laheria ,, Lakeria.
,, ,, ,, 18, ,, *Phasianux* ,, *Phasianus.*
,, ,, ,, 19, ,, two ,, ten.
,, ,, ,, 22, ,, 7 ,, 5.
,, ,, ,, 26, ,, Baghownie ,, Baghowinie.
,, ,, ,, 27, ,, Laheria ,, Lakeria.
,, 674, Title of Note No. XXIV, *for* "*Syphootis*" *read* "*Sypheotis.*"
,, 675, line 1 from top, *for* "*poecilornicha*" *read* "*poeciloryncha.*"
,, ,, No. 328, *for* "*longicandatus*" *read* "*longicaudatus.*"
,, 677, lines 9, and 10 from the top, *for* Wheater *read* Wheatear.
,, 684, line 5 from the top, *for* "*Pavimentala*" *read* "*pavimentata.*"

Page 684, line 7 from the top, *for* "Gaw Hills" *read* "Garo Hills."
,, ,, ,, 11, *for* "lops" *read* "lips."
,, ,, ,, 18 from the bottom, after the word "into" *insert* "two."
,, ,, ,, 15 from the bottom, *for* "breaking up into 3 scale 3" *read* "breaking up into 3 scales."
,, 688, Title of Note XL, *for* "*Forficdlidæ*" *read* "*Forficulidæ*."
,, 698, line 6 from the bottom, under locality, *for* "Nilambur, S. I." *read* "Nelliampatty Hills."

No. 3, Volume XXVI.

Page 731, line 13 from the bottom, instead of "3 other specimens belonging to" *read* "3 other specimens which belong."
,, 732, ,, 3 from the top, *instead of* "size larger, forearm 48" *read* "size smaller, forearm 48 mm."
,, ,, ,, 17 from the bottom, at the end of the sentence *add* (The figures in brackets are those of *Ægyptiaca*).
,, ,, ,, 15, for *Type* :—Adult O *read* *Type* :—Adult Female.
,, 733, ,, 6, for *Type* :—Adult O *read* *Type* :—Adult Female.
,, ,, ,, 4 from bottom, for *Type* :—Adult O *read* *Type* :—Adult Female.
,, 848, ,, 10 from the bottom, *for* "Ormaston" *read* "Osmaston."
,, ,, ,, 35, *for* "*belbi*" *read* "*beebei*."
Plate 1, at page 820, at bottom of page, *for* "*Mrotis*" *read* "*Myotis*" and "*murecola*" should be "*muricola*."
Page 820, Plate I, *for* "*Mrotis muricela*" *read* "*Myotis muricola*."
,, 822, line 15, "Hanatapara" should *read* "Hantapara."
,, 823, ,, 18, "XXV" should *read* "XXIV."

Page 823, line 30
,, ,, ,, 34
,, ,, ,, 41 } "Bharnabari" should be *omitted* as Hasimara includes Bharnabari.
,, 824, ,, 2
,, ,, ,, 3

Page 823, line 32, after "Jalpaiguri," *insert* district.
,, ,, ,, 49, "said to be" should be *omitted* and *instead of* "at the first two localities" 'everywhere' should be read.
,, ,, ,, 52, the note on the Club-footed Bat should be in brackets.
,, 824, ,, 11, "*Harpicorphalus*" *should read* "*Harpiocephalus.*"
,, ,, ,, 39, there should be a space between *Mus* and *homourus.*
,, 825, ,, 3, "*maximas*" should *read* "*maximus.*"
,, ,, ,, 17, after "rhinoceros" "of this species" should be inserted.
,, 841, line 6 from the bottom, *for* "*Beselaphus*" *read* "*Boselaphus.*"
,, 842, ,, 9 from top,*for* "*Quadricorus*" *read* "*quadricornis*"
,, ,, ,, 20, from top, *for* "*Dendiocyna*" *read* "*Dendrocyna.*"
,, 844, ,, 5, from top, *for* "*Pits*" *read* "*Bits.*"
,, ,, Note No. IX, line 3, from top, *for* "*Gaps*" *read* "*Gape.*"
,, 845, No. 3 *for* "*Boated* Eagle" *read* "*Booted Eagle.*"
,, 858, ,, 1055, *for* '*Rhytidocros*' *read* "*Rhytidocoros*".
,, 861, line 16, *for* "46′-5″ *read* "46·5 inches.
,, 862, Note No. XXVI, line 5, for "*pitcator*" *read* "*piscator.*"
,, 870, line 7 from the top, *for* "*Mgcalesis*"*read* "*Mycalesis.*"

In the Plate illustrating "Birds of Prey of the Punjab" published at page 326, Vol. XXVI, the bottom figure (Fig. 3), which depicts the underside of the Black-winged Kite (*Elanus cœruleus*) is incorrect—as the margins of the open wing are not all black. The underside of the primaries for less than half the length of the wings are the only black portions.

No. 4, Volume XXVI.

Page 997, in description of Plate *for* "*Stork-bellied Kingfisher*" *read Stork-billed King fisher*".
,, 1043, signature at the bottom of Miscellaneous Note No. VI, *for* "F. Reed" *read* "F. Field."
,, 1045, line 9, the second "flocks" *should read* "cocks."
,, 1051 line 2, *for* "from 5-10 A.M." *read* "in the morning" and *omit* foot-note reference to C. E. C. Fischer.

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THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U.

Part XXV.

With a Coloured Plate.

(*Continued from page 546 of Volume XXV.*)

Genus—*CATREUS*.

The Genus *Catreus* contains a single species very closely allied to the true Pheasants, but differing from them in having a long full crest.

The female differs from the male in plumage, but not to anything like the extent the true female *Phasianus* contrasts with the male.

The tail is very long, and is carried like that of *Phasianus*, not compressed like that of *Lophura* and *Gennæus*. It is composed of 18 feathers, the central pair very long and about five times as long as the outermost.

The wing is rounded, the fifth primary longest and first shorter than the tenth. The feet are strong and the tarsi armed with spurs, occasionally represented by knobs in the female.

The only species, *C. wallichi*, is confined to Indian limits.

Catreus wallichi.

The Cheer Pheasant.

Phasianus wallichi, Hardw., Trans. L. S., xv., p. 166 (1827) (Almorah); Hutton, J. A. S. F., xvii., pt. 2, p. 695 (1848); Blyth, Cat. Mus. A. S., p. 245 (1849) (N. W. Himalayas); Irby, Ibis, 1861, p. 235 (Kumaon); Jerdon, B. of I., iii., p. 527 (1863); Tytler, Ibis, 1861, p. 235, (Simla)

Beavan, ibid, 1868, p. 380 (Simla); Stoliczka, J.A.S.F., xxxvii., pt. 2, p. 68 (1868) (Satlej Valley); Hume, Nests and Eggs, p. 524 (1873); Marsh., B. Nest in I., p. 59 (1879); Hume and Marsh., Game-B., i., p. 169 (1878): Scully, Str. Feath., viii., pp. 345, 366 (1879) (Nepal); Marsh., Ibis, 1884, p. 423, (Chamba); Oates' ed., Hume's Nests and Eggs, iii., p. 412 (1890).

Lophoshoros wallichi, Less., Man. d'Orni, ii., p. 179 (1825); Vigne. P.Z.S., 1841, p. 6. (Chamba).

Phasianus stacei, Gould, Cent. Birds., p. 68 (1832) (Himalaya).

Catreus wallichi, Adams, F.Z.S., 1858, p. 499; Mitchell, ibid, 1858, p. 545; Gould. B. of Asia, vii., p. 18 (1865); Ogilvie-Grant, Cat. B. M., xxii., p. 317 (1893); Id., Man. Game-B., ii., p. 1 (1897); Blanf., Fauna B. I. Birds, iv., p. 82 (1898); Sharpe. Hand-L., i., p. 37 (1899); Oates, Cat. Eggs B. M., i., p. 56 (1901); Venour, Jour. B N. H. S., xvii., p. 812 (1907) (Dunga Gali, N. W. F. Province). Ward, ibid, p. 944 (1907) (Jhelum Valley); Magrath, ibid, xix., p. 159 (1909) (Murree); Finn, Avi. Mag., i., p. 129 (1910).

Vernacular Names.—Kahir, Chihir (*Nepal*); Cheer (*Kumaon, Garhwal and further West*); Bunchil, Boinchil, Herril (*Hills, N. of Mussoori*); Chummun, Chaman (*Chamba, Kulu, etc.*); Reear (*Karnar, Drawa, Pir Panjal, and Kaji Nagh*, Rehar (*Darg, N. W. F.*)

Description.—Adult Male.—Top of the head and feathers of the crest blackish brown, edged paler and with rather conspicuous grey tips; back of the head and upper nape the same but with the grey edges almost concealing the dark centres; line of feathers below the bare orbital space and ear-coverts hair-brown, almost black next the bill; chin, throat and sides of the neck greyish white, very faintly centred with brown streaks, obsolete in some specimens; lower nape and hind neck the same barred with black, scapulars and lesser wing-coverts barred ashy grey and black, each feather with a narrow grey fringe and with the subterminal black-bar glossed with green; upper tail-coverts and tail pale buffy grey to almost pure grey at the tip, barred with wide mottled bars of black and dark cinereous grey; outer tail feathers with the dark grey on the inner webs replaced to a great extent with deep chestnut.

Primaries brown, the outermost edged and barred with pale buff on the outer webs and both mottled and barred with the same colour on the inner webs; secondaries the same, becoming more and more mottled in characters towards the innermost, which have one broad subterminal bar of black, a second bar less definite in shape and the rest of the feather irregularly mottled with black and buff; greater and median wing-coverts like the lesser, but with more of a buffy-ochre tinge, in some cases becoming here and there almost rufous.

Below greyish-white, more or less tinged with rufous-buff posteriorly and on the flanks each feather barred with black, but with these bars concealed on the fore neck and upper breast, and very conspicuous on the lower breast and flanks; the feathers of the breast also have faint brown shaft stripes; centre of abdomen blackish, more or less mottled with rufous buff; vent and under tail-coverts rufous; thigh-coverts dirty rufous buff.

Colours of Soft Parts.—Orbital skin crimson-scarlet or crimson, sometimes dotted with little pink, or pinkish-white pimples; iris golden hazel or reddish hazel, sometimes, according to Hume, an orange-brown; bill pale yellowish horny, more rarely pale brownish or bluish horny; legs plumbeous or greyish brown, occasionally with a fleshy tint, especially on the hinder parts; toes paler and more fleshy and soles paler still.

Measurements.—The series of males of which I have been able to take measurements, some 40 in number do not show a very great range of variation. Including the 22 specimens in the British Museum, they measure:—

Wing from 9·3″ (235 mm.) to 10·6″ (269·2 mm.), and averaging 9·9″ (250·5 mm.); tail 15·3″ (388·6 mm.) to 23·0″ (584·2 mm.), with an average of 19·0″ (481·8 mm.); tarsus about 3″ (76·2 mm.); spur generally about ·5″ (12·5 mm.), rarely as such as ·75″ (19·0 mm.); bill at front about 1·1″ (27·9 mm.), and from gape about 1·3″ (36 mm.)

"Weight, 2 lbs. 10 ozs. to 3 lbs. 7 ozs." (Hume.)

In a letter to me, Col. R. H. Rattray recorded the weight of one shot at Mussoorie as just on 4-lbs.

Wilson (Mountaineer) mentions having obtained birds with tails of 28″ (716 mm.), and this observer is invariably so correct that we must accept his statement, but such birds are no doubt quite exceptional. The crest runs up to 3·6″ (91·4 mm.), and is usually about 3″ (76·2 mm.)

Adult Female.—Head similar to that of the male, but with buff or ochre-buff instead of grey edging and tips to the feathers; hind neck and nape greyish-white with bold black centres; mantle pale chestnut—varying a good deal in depth in different individuals—each feather with cream shaft streaks, greyish edges and bold black bars; lower back and rump ashy-brown, mottled with black and, to a much less extent with buff; tail and upper tail-coverts with alternate bands of mottled rufous and black and bolder black and buff; the longer tail-coverts with more black and less buff.

Primaries brown, regularly barred with buff on the outer webs and with chestnut on the inner; secondaries mottled blackish-brown, and chestnut-buff with four broad bars of creamy-buff edged above and below with black; greater and median coverts mottled black and chestnut-buff with broad tips of creamy-buff.

Below chin, throat and fore neck creamy-white; breast black, the feathers with broad white edges and white central streaks; remainder of lower surface pale chestnut each feather edged with creamy-buff; flanks anteriorly like the breast, gradually changing posteriorly until they are almost the same as the belly; centre of abdomen buff; under tail-coverts pale rufous, mottled slightly with brown.

Colours of Soft Parts.—Similar to the same parts in the male, but the facial skin is a duller, dingier crimson, more a brick-red.

Measurements.—Wing, 8·6″ (223·4 mm.) to 9·7″ (245·6 mm.), average (28 birds) 9·15″ (231·6 mm.); tail, 12·5″ (317·5 mm.) to 18·6″ (467·4 mm.), with an average of 15·0″ (381·0 mm.); tarsus, 2·8″ (71·6 mm.) to 3·1″ (78·7 mm.), generally a little under 3″ (about 75 mm.); bill at front about 1″ (25·4 mm.) and from gape 1·2″ (30·4 mm.). The spur is only a mere knot when present, as a rule there is none. The crest runs up to 2·7″ (68·5 mm.), but is more often about 2″ (50·8 mm.)

"Weight, 2 lbs. to 2 lbs. 12 ozs." (Hume.)

Distribution.—The West of Nepal, Kumaon, Garhwal, Tehri Garhwal, Simla States, Bussahir, Chamba and at least as far West as Dunga Galli in the Hazara District of the N.-W. Frontier Province.

Ward says that it is not found in Kashmir proper, though it is found in Kishtwar and the Jhelum Valley. Major H. L. Haughton, then of the 36th Sikhs, obtained specimens at Karnar and Drawa (Kashmir), and also at Pir Panjal and Kaji Nag. Nor can they be very rare there, for on one day he informs me he managed to shoot eight birds.

It is possible that these pheasants inhabit Nepal a good deal further to the East than Hume thought to be the case. Before the traffic in bird skins was practically stopped in Darjiling the Nepalese occasionally brought these skins into Darjiling for sale and less often birds alive, which they said had been trapped in the Valley of Nepal on the higher hills to the North. I have myself seen such skins, and one of my eggs was obtained with the skins of the parent bird from Nepalese in Darjiling.

Scully, it must be remembered, found these birds very common in captivity in Khatmandu, and believed that the bird was by no means uncommon to the North of the Valley. No one yet has collected in Nepal off the beaten tracks, and even Hodgson was never, evidently, in a position to collect in the real interior of the country, whilst Residents since his time appear to have made no attempt to do so.

Nidification.—This beautiful Pheasant breeds throughout the above area at elevations between 5,000 and 9,000 feet, occasionally lower than the former, and, equally occasionally, above the latter. The breeding season commences early in April and lasts throughout May and June. In the lower ranges most eggs will be taken in the end of April and early May, whilst in the higher altitudes none are likely to be taken before the end of May, and more in the early half of June. The latest date I have recorded is the 3rd of July for incubated eggs.

Owing to the fact that Europeans do all they can to prevent the eggs of this bird being taken, and, wherever they are sufficiently numerous to make it worth while, do their best to preserve these pheasants, there is very little on record about their nidification.

In addition to this, the fact that they nearly always breed in the wildest and most precipitous hills makes their nests and eggs very hard to find, and consequently full clutches of Cheers' eggs are very rare in collections. The nests are very rough affairs, merely a collection of leaves and rubbish in some hollow, either natural, or scratched out by the birds themselves. It is placed in amongst bushes,bracken or grass at the foot of, or on the side of, some steep hill or cliff, and almost invariably in very broken ground. Hume found his three nests at the foot of almost vertical cliffs, " broken into ledges and steps and studded with down-trailing bushes, tufts of grass and, growing here and there out of some larger cleft or wider ledge, a few stunted trees." This description appears to be very typical of the normal breeding and nesting haunts of the Cheer, and the few details I have been able to secure from sporting friends simply confirm what Hume has written. It is interesting to note that Hume took this bird's nest at Nagthiba as long ago as 1861, and that only three years ago, 1915, I received from a friend a pair of eggs taken from the same place.

The cock birds are monogamous, a fact which has been long known, for Wilson recorded that " both male and female keep with the young brood, and seem very solicitous for their welfare." In 1916, Mr. A. Wimbush of the Forest Service, came on a very interesting instance of the cock Cheer's care for his family. He writes in *epistola* :—

> "This morning when out after Gural in the Jaunsar " division of the Dehra Dun District at an elevation of about " 8,000 feet, I came suddenly upon a pair of Cheer Pheasants " with a brood of chicks about one or two days old.
>
> "The parent birds which appeared to have been sitting " touching one another, as though each covering half the " chicks, waited until I was some ten or twelve yards away, " and then started a most lively demonstration.
>
> "The chicks ran in all direction, one coming straight " towards me, and the two old birds with tails spread, wings " arched and neck feathers ruffled ran backwards and forwards " in front of me, clucking just like an old hen does if a dog " interferes with her chicks.
>
> " The most interesting point was that the chief demonstrator " was the cock bird. Without the least sign of fear he

" approached to within about eight yards of me, assuming the " most threatening attitude.

" This continued for a moment or two, until all the chicks " had hidden in the grass, whereupon both old birds began to " walk away, calling all the time to the chicks."

If the eggs are at all incubated, the hen birds sits very close, and may be nearly trodden or before she will rise. In such cases, she gets off her nest with a good deal of fluster and noise, but usually the birds sneak off very stealthily.

The number of eggs in a full clutch seems to be anything from eight to fourteen, most often ten or eleven. Hume found thirteen in one nest. Adams says they lay from nine to twelve, and Wilson says nine to fourteen, and Whymper took clutches with from eight to eleven eggs in Garhwal.

In appearance the eggs are just like small hens' eggs varying in colour from a pale creamy white to a pale stone or brown, sometimes with a faint chocolate or creamy tint in it. They are never of the rich, warm cafe-au-lait tint so often found in the eggs of the Jungle-Fowl and the Kalij Phesants, and, on the other hand, most eggs have the faintest tinge of olive-green in them, hardly discernible unless placed against other eggs.

Frequently the eggs are spotted and speckled with brown, and, curiously, these spots seem to be nearly always at the small end. This is the case in four out of the only six eggs I have in my collection, in the majority of those in the British Museum and at Tring and again in Mr. S. L. Whymper's collections. As a rule these spots and specks are scanty and poorly coloured, but I have one egg which is quite richly blotched with rich brown at the small end.

In shape they are the same as hens' eggs, occasionally rather drawn out, but never a peg-top shape like those of the true Phasianus group. The texture is hard, close and strong with a fair gloss.

Thirty eggs vary in length from 49·9 mm. to 57·1 mm., and in breadth from 36·5 mm. to 40·6 mm. The average is 53·3 mm. by 38·7 mm.

General Habits.—The Cheer may be found at any altitude between 4,000 feet in the cold weather, and 10,000 feet or more in the summer, but as a rule keep between about 6,000 feet and 9,000 feet. They haunt the wildest of country, and though not found above the forest level they are not birds of heavy forest, but rather of the scanty forest and thick grass and undergrowth which grow on the more precipitous hills and cliff sides. According to various authors and writers, they seem to go about in flocks of any thing from half a dozen to a dozen or more, probably only the family party of the last hatching. They do not keep very close together, but scatter over a considerable area, a habit of considerable importance to the sportsman in pursuit of them, as he can pick them up one or two at a time instead of flushing the whole covey together.

No account of this Pheasant can be considered complete without "Mountaineer's" most interesting notes, for no one since has written any account to compare with his. I therefore make no apology for quoting them in full, although so many have used them before me.

> "Though far from being rare, fewer perhaps are met with "than of any other kind unless it is particularly sought for, "always excepting the Jewar. The reason of this may be "that the general character of the ground where they resort "is not so inviting in appearance to the sportsman as other "places; besides, they are everywhere confined to particular "localities, and are not, like the rest, scattered indiscriminately over almost every part of the regions they inhabit. "Their haunts are on grassy hills with a scattered forest of "oak and small patches of underwood hills covered with the "common pine near the sites of deserted villages, old cow-"sheds, and the long grass amongst precipices and broken "ground.
>
> "They are seldom found on hills entirely destitute of trees "or jungles, or in the opposite extreme of deep shady forest; "in the lower ranges they keep near the top of the hills or "about the middle, and are seldom found in the valleys or "deep ravines. Further in the interior they are generally low "down, often in the immediate vicinity of the villages, except "in the breeding season, when each pair seeks a spot to perform the business of incubation: they congregate in flocks "of from 5 or 6 to 10 or 15, and seldom more than two or 'three lots inhabit the same hill.
>
> "They wander a good deal about the particular hill they are "located on, but not beyond certain boundaries, remaining "about one spot for several days or weeks, and then shifting "to another, but never entirely abandoning the place, and "year after year they may, to a certainty, be found in some "quarter of it.
>
> "During the day, unless dark and cloudy, they keep concealed in the grass and bushes, coming out morning and "evening to feed. When come upon suddenly while out, they "run off quickly in different directions, and conceal themselves in the nearest cover, and seldom, more than one or two "get on the wing. They run very fast, and if the ground is "open and no cover near, many will run two or three hundred "yards in preference to getting up.

"After concealing themselves they lie very close, and are "flushed within a few yards. There is, perhaps, no bird of "its size which is so difficult to find after the flock have "been disturbed and they have concealed themselves; where "the grass is very long, even if marked down, without a good "dog it is often impossible to flush them, and even with the "assistance of the best dogs not one-half will be found a "second time. A person may walk within a yard of one, and "it will not move. I have knocked them over with a stick, "and even taken them with the hand. In autumn the long "grass, so prevalent about many of the places they resort to, "enables them to hide almost anywhere; but this is burnt by "the villagers at the end of winter, and they then seek refuge "in low jungle and brushwood, and with a dog are not so "difficult to find.

"Both males and females often crow at daybreak and dusk, "and in cloudy weather sometimes during the day. The "crow is loud and singular, and, when there is nothing to "interrupt, the sound may be heard for at least a mile. It is "something like the words *chir-a-pir*, *chir-a-pir*, *chir chir*, *chirwa*, "*chirwa*, but a good deal varied; it is often begun before complete daylight, and in spring, when the birds are numerous, "it invariably ushers in the day: in this respect it may rival "the domestic cock. When pairing and scattered about, "the crow is often kept up for nearly half an hour, first "from one quarter, than another; and now and then all "seem to join in a chorus. At other times it seldom lasts "more than five or ten minutes.

"The Cheer Pheasant feeds chiefly on roots, for which it "digs holes in the ground, grubs, insects, seeds and berries, "and, if near cultivated fields, several kinds of grain form a "portion of its diet; it does not eat grass or leaves like the "rest of our Pheasants.

"It is easy to rear in confinement, and might, without "difficulty, be naturalized in England, if it would stand the "long frosts and snows of severe winters, which I imagine is "rather doubtful.

"This bird flies rather heavily, and seldom very far. Like "most others, it generally utters a few loud screeches on "getting up, and spreads out the beautifully barred feathers "of its long tail, both when flying and running. It does not "perch much on trees, but will occasionally fly up into one "close by, when put up by dogs. It roosts on the ground "generally, and when congregated together, the whole flock "huddle up in one spot. At times, however, they will roost "in trees and bushes."

Two points in this excellent account require comment. First as regards their flight; few sportsmen will agree with Wilson's description of it, and all my correspondents give the Cheer credit for being a most difficult bird to shoot, not only on account of its great speed in flight, but also because of its habit of hurling itself headlong down cliff sides with almost closed wings, giving the snappiest of snap-shots, unless one is close to the level at which it intends to alight. Close to this point it gradually moderates its pace, somewhat opening its wings, spreading its tail and in the words of Hume—"sweeps off in graceful curves right or left, shortly dropping suddenly, almost as if shot, into some patch of low cover."

The second point which attracts notice is the statement that these birds roost on the ground; doubtless they do so sometimes, but over most of their habitat I am told they roost either on stunted trees, high bushes or on the summit of high rocks.

The description given by Mr. Wimbush of the demonstration made by a pair of pheasants in defence of their young shows that attitudes supposed to be awe-inspiring are indulged in by Cheer. Finn corroborates this, and remarks :—

> "This species is not supposed to show off, but a vicious "male in the Calcutta Zoo used to show off in the Common "Pheasant's attitude aslant with spread tail when trying to "attack, and as the show position so commonly seems to be "the fighting one too, I expect the species does thus display "when courting. This bird made a murmuring note when "approached, like the Kalij Pheasant."

It is said to be an excellent bird for the table and one of my correspondents adds "It is the only game bird I have shot in India which in any way reminds me of the English Pheasant and the flesh, especially, if kept for a short time in the cold weather is much more like that of true Phasianus than that of the Jungle fowl or Kalij."

Genus—LOPHURA.

The Genus *Lophura* contains three species of Pheasants, which are rather closely allied to those of the genus *Gennæus*, but the tail is differently shaped, though compressed as in that group, and the naked portion of the face is produced above the forehead and again below the cheeks into the fleshy pendant wattles.

The wing is similar to that of the Kalij Pheasants, the first primary equal to the ninth or tenth, the fifth and sixth sub-equal and longest. In both *Gennæus* and *Lophura*, the tail is composed of sixteen feathers, but in the former the central tail feathers are longest, whereas in the latter the third pair are a little longer than the two central pairs.

The crest is composed of feathers with shafts bare at their bases and heavily plumed at the tips. In *G. rufa* four-fifths of the shafts are bare, but in *G. diardi* merely the bases.

The feet and tarsi are stout and armed, in the male, with a well-developed spur.

There are three species in the Genus as now restricted, two of which are found in the limits of the present work, the third *Lophura ignita* being obtained in the forest of Borneo.

KEY TO SPECIES.

A. Mantle deep purplish blue.
  a. Upper breast black, glossed blue; central tail feathers white......... *L. rufa* ♂
  b. Upper breast dark grey, vermiculated with white central tail feathers black.................... *L. diardi* ♂
B. Mantle chestnut.
  c. Wing-coverts chestnut, vermiculated with black; outer tail feathers black................................ *L. rufa* ♀
  d. Wing-coverts black, with buff broken bars; outer tail feathers dark chestnut...................... *L. diardi* ♀

LOPHURA RUFA.

The Fire-Back.

Phasianus ignitus, Raffles (nec Shaw and Nodder) Trans. Linn. Soc., xiii., p. 320 (1822) (Sumatra); Daniell, F. Z. S., 1882, p. 24; Elliott, Ibis, 1878, p. 412.

Phasianus rufus, Raffles, Trans. Linn. Soc., xiii, p. 321 (1822) (Sumatra); Gray in Griffiths ed. Cuv., iii, p. 28 (1829).

Phasianus castaneus, Gray in Griffiths ed. Cuv., iii., p. 28 (1829) (Penang).

Gallus macartneys, Schinz (nec. Temm.) Nat. abild. Vog., p. 28, pl. 93 (1833) (Sumatra).

Euplocamus ignitus, Gray, Ill. Ind. Zool., ii., pl. 39 (1834); Blyth, Cat. Mus. As. Soc., p. 243 (1849) (Sumatra); Blyth and Wald., Cat. Mamm. and Birds, Burma, p. 149 (1875) (Tennasserim River); Elliott, Ibis (1878) p. 124.

Euplocamus vieillotti, Gray, List Gen. E. 2nd ed., p. 77 (1841); Gould, B. of Asia, vii., pl. 15 (1852) (Malacca); Hume, Str. Feath., ii., p. 481 (1874) (Tennasserim); id, ibid, iii., p. 324 (1875) (Tennasserim); Sclater, P.Z.S., (1875) p. 380; Hume, Str. Feath., v., p. 119. (1877) (Tennasserim); Hume and Marsh , Game-B. In., i.. p. 213 (1878); Hume and Dav., Str. Feath., p. 438 (Pakjan); Elliott, Ibis, 1878, p. 413; Kelham, Ibis, 1881, p. 532 (Perak); Oates, B. of Burma, ii., p. 320 (1883) (L. Tennasserim).

Eaplocamus rufus, Hume, Str. Feath., v., p. 121 (1877).

Euplocamus sumatranus, Dubois, Bull. Acad. Belg., (2), xlvii., p. 825 (1879) (Sumatra).

Lophura rufa, Ogilvie-Grant, Cat. B.M., xxii., p. 268 (1893); id, Man. Game-B., i., p. 244 (1895); Blanf., Fauna. B. I., iv., p. 87; Oates, Man. Game-B, i., p. 379 (1898); Sharpe Hand-L., B., i., p. 34 (1899); Oates, Cat. Eggs, B.M., i., p. 52 (1901).

Lophura vieillotti, Buttikofer Notes Ley. Mus., xvii., p. 181 (1895).

Lophura sumatrana, Buttikofer, Notes Ley. Mus., xvii., p. 177 (1895).

Vernacular Names.—Knock-wah (*Siamese*); Mooah-Mooah, (*Malay*).

Description.—Adult Male.—Plumage above including thick bushy crest, lesser wing-coverts and upper tail-coverts a deep rich metallic purple-violet; lower back a fiery golden red, passing into a rich copper chestnut on the rump, the concealed bases of these feathers coloured like the upper back; two pairs of central feathers white, inner webs of third pair white, outer webs of these and whole of remaining tail feathers black, more or less glossed with violet. Wing quills brown, darkest and almost black on the innermost secondaries; greater coverts black, glossed, more especially at the edges and tips, with a more decided green tint than that on the back, median coverts where visible the same glossy green.

Below like the mantle, the sides of the lower breast and flanks with conspicuous white shaft-stripes faintly tinged with chestnut in some specimens; centre of abdomen black; vent and thigh-coverts dingy blackish-brown; under tail-coverts black glossed with the same colour as that on the wing-coverts.

Many birds, apparently fully adult, have a curious sprinkling of the finest specks of white arranged as a narrow irregular line on each feather of the metallic plumage of the back and with similar terminal lines, but of reddish instead of white, on the wing quills.

Birds from Sumatra, it should be noted, have the lines on the flanks chestnut instead of white, but with the material available it is impossible to say whether this is constant and would suffice to give this form sub-specific rank.

Colours of Soft Parts.—Irides bright pale red; facial skin pale smalt blue or bright smalt blue; bill white or pale fleshy horn; tarsus in front and toes bright vermilion red, back of tarsus paler with soles and claws reddish white; spur fleshy pink or pale vermilion; skin of throat showing through the scanty feathering fleshy pink. (Davison).

Measurements.—Wing, 10·0″ (254·0 mm.) to 11·7″ (297·1 mm.), average of thirty birds 11·3″ (286·1 mm.); tail, 9·0″ (228·6 mm.) to 12·8″ (325·1 mm.), average, 11·3″ (286·1 mm.); tarsus, 4·25″ (107·9 mm.) to 4·8″ (121·9 mm.), average 4·55″ (115·5 mm.); spur, 1·25″ (31·7 mm.) to 1·7″ (43·2 mm.); crests, 1·5″ (38·1 mm.) to 1·7″ (43·2 mm.).

"Weight, 4·25 lbs. to 5 lbs." (Hume.)

Hume gives the length of the bill from gape as 1·6″ to 1·8″ (40·6 to 45·7 mm.).

A Young Male apparently moulting into adult plumage, has the upper tail-coverts blackish-brown, mottled with chestnut at the tips; the white central tail feathers have their basis and broad shaft-stripe brown; the whole of the under surface is black with hardly a vestige of gloss and the gloss on the upper parts is scanty and dull.

A Young Male in first plumage is dull earthy brown above, much freckled with rufous, the head is darker and the incipient crest is tipped with chestnut; below the chin and throat are dull albescent; neck dark brown; breast and flanks dark brown, each feather broadly edged with white; centre of abdomen and vent dull white; under tail-coverts brown; thigh-coverts like the flanks.

Adult Female.—Head, neck and upper back bright chestnut rufous; lower back and remainder of upper plumage a more buff rufous, profusely covered with narrow irregular bars of black: the colours of the upper and lower back grade into one another, and the feathers of the former show more or less black stippling on their terminal halves; tail and upper tail-coverts a still richer, deeper chestnut than the head, the outer tail feathers immaculate, the inner and upper tail covers narrowly barred with black.

Wings like the back, but rather more chestnut in general tone.

Below, chin and throat rufescent white, changing into pale chestnut on the fore neck; breast and lower neck bright chestnut, the feathers with broad white edges to the basal halves; remainder of lower plumage black with broad white edges to each feather, and with the black more or less mixed with chestnut on the flanks; centre of abdomen and vent mottled white; under tail-coverts black and chestnut; thigh-coverts black and chestnut with white fringes.

Individuals vary a great deal in the extent to which the chestnut of the upper breast encroaches on the lower breast and flanks. In some the whole of the lower plumage has the black more or less mixed with chestnut, whilst in one or two specimens, on the other hand, the chestnut is almost entirely confined to the neck and extreme upper breast.

Colours of the Soft Parts.—Iris bright pale red; facial skin smalt blue; bill, cere, gape and base of both upper and lower mandibles dark horny brown; rest of bill horny white, greenish white, pale yellowish; legs bright red or vermilion in front and on the toes, paler behind and on soles which are a pinkish white, claws hornywhite. (Davison.)

Measurements.—Wing, 8·8″ (223·5mm.) to 10·4″ (264·1mm.), average of thirty-four birds, 9·9″ (251·2mm.); tail, 6·5″ (165·1 mm.) to 9·3″ (236·2 mm.), average, 8·3″ (210·8 mm.); tarsus, 3·4″ (86·3 mm.) to 4·1″ (104·1 mm.); crest about 1·5″ (38·1 mm.); bill at front about 1·3″ (33·0 mm.) and from gape about 1·6″ (40·6 mm.).

Hume gives the wing of the female as running up to 10·75″ (275 mm.)

" Weight, 3 to 3·5 lbs." (Hume.)

The Young Female is duller above and the chestnut of the head is little, if any, brighter than the rest of the plumage. The mottlings are generally stronger and more plentiful and the scapulars have a few broad bars of black. Below the chestnut is but slight in extent, and is confined to the fore neck.

Distribution.—South Western Siam, the Malay Peninsula and Sumatra. The female in the British Museum Collection marked " Borneo " is of course not from that island.

This fine Pheasant only enters our limits in the South of Tennasserim about as far North as the latitude of Tennasserim Town, but is apparently very common further South.

Nidification.—There is, as far as I can find, absolutely nothing on record about the nidification of this Pheasant in a wild state, and very little in caged state, although it is a common enough bird in captivity. Hume's collection contains a single egg laid by a bird under the latter conditions in July, and the only eggs laid by wild birds that I know of are two in my own collection purchased from the Waterstradt Collection and taken in Malacca on 4th April.

The egg obtained by Hume measures 2·25″ by 1·68″ (57·1 by 39·6 mm.), the two in my own collection measure 51·0 by 39·3 mm. and 52·7 by 39·5 mm. In shape and texture they are similar to rather thin shelled domestic-fowls' eggs, and in colour they are a pale stone or buff. Hume calls his egg a delicate cafe-au-lait, but I should prefer to call this also a very pale dull buff. The surface in all these eggs is smooth, but with little gloss, and my two eggs are stained here and there from the rubbish upon which they were laid.

The only notes obtainable about the wild-laid eggs were as follows:—

> " Brought in by native collectors with the skin of the
> " adult bird; said to have been placed in a nest composed of
> " dead leaves, grass and bamboo spates under some thick
> " bushes in dense evergreen forest."—Malacca, 4/4/1899., low

Beyond the fact that of the eggs known one was laid in July and two in April; it is impossible to say when the breeding season commences or ends.

General Habits.—The Fire-Back appears to be a bird of the dense low country evergreen forest, not being found in the higher hills anywhere within its habitat. Over most of its range it is a comparatively common bird, and many are trapped and kept in confinement by the natives. Easy to tame and easy to feed, it thrives even when kept in a comparatively small enclosure, but it has not yet been induced to breed.

Like the Kalij Pheasants, this bird is a haunter of thick jungle, generally evergreen, with dense undergrowth, less often bamboo or secondary growth in abandoned cultivation.

It is nearly half a century since the much-quoted account of this bird's habits was written by Davison yet since then practically not one scrap of information has been added to our knowledge or, at all events, recorded anywhere. Siam and the Malay Peninsula are now exceptionally well off for good scientific and field naturalists, and it is to be hoped that before long they will supply the deficiency.

Davison writes :—

> "These birds frequent the thick evergreen forests in small "parties of five or six; usually there is only one male in the "party, the rest being females, but on one or two occasions "I have seen two males together; sometimes the males are "found quite alone. I have never heard the males crow, nor "do I think that they ever do so; when alarmed, both males "and females have a peculiar sharp note, exceedingly like "that of the large Black-Backed Squirrel (*Sciurus bicolor*). "The males also continually make a whirring sound with "their wings, which can be very well imitated by twirling "rapidly between the hands a small stick, in a cleft of which "a piece of stiff cloth has been transversely placed. I have "often discovered the whereabouts of a flock by hearing this "noise. They never come into the open, but confine them-"selves to the forests, feeding on berries, tender leaves, and "insects and grubs of all kinds, and they are very fond of "scratching about after the manner of domestic poultry, and "dusting themselves. When disturbed, they run rapidly "away, not in different directions, but all keeping much "together; they rise at once before a dog, getting up with a "great flutter, but when once well on the wing, fly with a "strong and rapid flight; they seldom alight again under a "couple of hundred yards, and usually on the ground, when "they immediately start running.
>
> "I noticed on one occasion a very curious thing. I had "stalked an Argus, and while waiting to obtain a good "shot, I heard the peculiar note, a sort of *chukun, chukun*, "followed by the whirring noise made by the male Fire-Back, "and immediately after saw a fine male Fire-Back run into "the open space, and begin to chase the Argus round and "round its clearing. The Argus seemed loath to quit its own "domain, and yet not willing to fight, but at last, being

"hardpressed, it ran into the jungle. The Fire-Back did not "attempt to follow, but took up a position in the middle of "the clearing, and recommenced the whirring noise with his "wings, evidently as a challenge, whereupon the Argus slowly "returned, but the moment it got within the cleared space, "the Fire-Back charged it, and drove it back into the jungle, "and then, as before, took up his position in the middle of "the space and repeated the challenge. The Argus imme-"diately returned, but only to be again driven back, and this "continued at least a dozen times, and how much longer it "would have continued I cannot say, but a movement on my "part attracting the birds' attention, they caught sight of me, "and instantly before I could fire, disappeared into the jungle. "The Argus never made the slightest attempt to attack the "Fire-Back, but retreated at once on the slightest movement "of the latter towards it, nor did I see the Fire-Back strike 'the Argus with either bill, wings, or spurs."

LOPHURA DIARDI.

The Siam Fire-Back.

Euplocamus diardi, Bonap. Comp., Rend., xi., iii., p. 415 (1856), ox. Temm., M. S.

Diardigallus praelatus, Bonap., Comp. Rend., xi., iii., p. 415 (1856); Schl., Hand-L.d., Dierk, i., p. 379, Atlas Aves, pl. v., fig. 55 (1857); Gould, B. of A., vii., p. 21 (1860).

Diardigallus fasciolatus, Blyth , J.A.S.B., xxvii., p. 280 (1858).

Euplocamus praelatus, Sclater, List. Bhas., p. 6, pl. 6 (1863) (Siam, Shan States); Schomb. Ibis, 1864, p. 259 (E. Lao Country); Sclater and Wolf, Zool. Sketches, (2) pl. 35, (1867); Elliott, Man. Bhas., ii., p. 24 (1872).

Lophura diardi, Ogilvis-Grant, Cat. B. M., xxii., p. 290 (1893); id, Hand-L., Game-B., i., p. 247 (1895); Gyldanstolpe, Kungl. Svensk, Hand-L. 50, No. 8, p. 67 (1913); id. Journ. N. H. Soc., Siam, i., No. 4 p. 235 (North Siam).

Vernacular Names.—Kai-pha (*Siamese*); Kai-fan—(*Laos*).

Description.—*Adult Male.*—Crown from forehead to nape, sides of the head behind and over the ears, chin, throat and crest black; the crest glossed with purple-blue; the feathers of the chin, throat and foreneck, especially the latter, are very scanty, the fleshy red skin showing through; back and upper breast very finely verminiculated grey and black, the general effect being a rather dark grey; lower back like the back, but each feather with a broad terminal bar of gold, this bar of colour concealing the grey bases; rump and upper tail-coverts, with the exception of a few of the longest, rich metallic blue-black, each feather fringed with deep copper-crimson; longest tail-coverts black with a copper sheen and edges of metallic green. Tail black completely glossed with greenish blue, more distinctly blue on the outer than the inner webs.

Below black, glossed with deep blue, but with the brownish bases of the feathers showing through. Wings like the back, but the scapulars with a broad subterminal band of black followed by a narrow line of pure white; lesser and median coverts with similar markings, but much less pronounced.

Colours of the Soft Parts.—Iris red, brown, red-brown or hazel; bill pale greenish horny; facial skin bright scarlet-red; legs and feet rich deep scarlet or crimson-red, toes and spurs dark horny-brown, the latter tipped paler, and sometimes wholly of a pale horny white colour.

> "Iris burnt sienna, light red to vermilion; bill pepper-"brown; legs vermilion". (E. G. Herbert).

Measurements.—Wing, 230 to 256 mm., average eight birds, 250 mm.; tail, 345 to 386 mm.; tarsus about 100 mm.; crest 70 to 90 mm.; bill from gape about 32 mm. and from front to tip about the same.

Adult Female.—Crown, nape and sides of the head a dingy pale earth-brown, shading into pale rufous, white on chin, throat and fore neck; back and sides of neck, back and scapulars chestnut red, with faint dusky margins to each feather, and a certain amount of black stippling in tiny irregular bars. Lower back, rump and upper tail-coverts vermiculated or mottled with pale rufous buff and black; the bars broader and better-defined on the back than elsewhere. Tail, two central pairs of feathers, the same with broad bars of black, boldly mottled with buff on their terminal halves, outer feathers a rich chestnut red.

Below chestnut, the breast and fore neck like the mantle; the lower breast, abdomen and flanks with bold edgings of white to each feather; centre of the abdomen dull brown and white; under tail-coverts unmarked chestnut, the bases mottled with brown.

Visible portions of the wing like the tail, but with the buff bars and mottlings even more boldly defined; primaries a lighter brown with narrow mottled bars of pale buff.

Colours of Soft Parts.—Iris red or brown; bare skin of face dull scarlet brick-colour, pale dull scarlet or dull scarlet; bill horny brown, tip and gonys paler; legs and feet a very rich deep red, scarlet red or crimson red; soles paler and claws pale horny or horny-white.

> "Iris raw umber, burnt sienna, Venetian red or Naples yellow; "bill above black, the lower mandible yellowish horny; some-"times the upper mandible is more brown than black; feet and "legs vermilion, but paler and duller than in the male."
>
> (E. G. Herbert.)

Measurements.—Wing, 220 to 238 mm. average of eight birds 228 mm.; tail 220 to 260 mm.; tarsus 75 to 85 mm. crest very short and of ordinary feathers, not distinguishable from the rest unless erected; bill from gape about 30 mm., the same as from the feathers of the forehead to the tip.

The Young Male is like the adult female, but is duller and more mottled with blackish above; the breast is more brown, and less chestnut, and has not got the well-defined white edgings to the feathers of the lower breast and flanks. The tail feathers are more barred with black and not quite so rich a chestnut.

Colours of the Soft Parts.—Iris brown or dull blue-brown; facial skin dull fleshy red; bill pale yellowish horny; feet and legs dull fleshy pink.

In the Autumn in the first moult the young male appears to put on the complete plumage of the male, retaining a few feathers here and there of the female, which are, presumably, dropped during the ensuing winter, and replaced with adult feathers.

There is a young male in the British Museum collection in this stage with a wing of 210 mm. and no crest.

Distribution.—Siam, Annam and Cambodia, and it has also been reported from the Southern Shan Hills and the Eastern Lao Country. It possibly occurs also in the Eastern parts of Karennee from whence I have had it doubtfully reported.

Nidification.—Nothing recorded. Eggs laid in captivity are said to be indistinguishable from those of *Lophura rufa.* This bird has bred in the Zoological Society's gardens in London with Silver Pheasants during a period when hybrids were attracting much attention, to satisfy which very useless curiosity, a good deal of experimental work was done by people who forgot that environment alone could create stable sub-species such as now exist.

General Habits.—There is absolutely nothing on record as to this bird's habits. It appears to haunt heavy forest at low elevations, where there is a great deal of undergrowth and where the climate is so damp that most of this is evergreen.

Sir H. Schomburgh's interesting notes on some captive birds which appeared in the Ibis (1864) gives us some insight into its habits.

He writes:—

> "The Kai-pha I speak about was quite tame, and ran about "in the verandah of my residence . . . . . Although "the Kai-pha, in splendour of plumage cannot be compared "either with the Gold or the Silver Pheasant, still there is "something graceful in its figure and stately in its walk . . " . . I allowed him to leave his coop and to walk about "in the house, where he picked up insects, apparently more "congenial to him than the everyday food of paddy (rice in "the husk). When he saw a spider or ant crawl up the walls "in the room, he would fly up several feet to catch it. He "was very partial to plantains and bananas, indeed to almost

> "any kind of fruit; this predilection he may have acquired in "his state of domestication. Both in his coop and when "walking about in the verandah, he emitted frequently a "faint sound; but when disturbed or alarmed, the sound was "harsh; and when flying up, it was with a whirring noise "similar to that of our Partridges, but stronger. The female "though so different in plumage, has the same manners as "the male."

They are very commonly trapped by the Siamese and kept as, caged birds, being frequently brought into Bangkok and sold there for this purpose. Mr. E. G. Herbert kept some of these birds, and his interesting notes to me show that the young males in the first autumn moult acquire practically the complete plumage of the adult male. He was successful in hatching out some eggs under hens, some of the young birds reaching maturity. Mr. Herbert's observations confirm those of Sir H. Schomburgh's.

The traps used to catch the wild birds appear to be of two kinds. In one nooses are set round about a decoy in jungle haunted by these Pheasants, and in the other nooses are set in openings in low brush-wood fences in similar places; the birds wander down the fences, and then in walking through them get caught. In fact, the trap is the same as already described as being in use amongst so many of the Eastern wilder tribes.

As might be expected, they are said to be good eating, though one of my correspondents refers to them as "very dry."

(*To be continued.*)

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY

OF THE

BOMBAY NATURAL HISTORY SOCIETY.

(By R. C. Wroughton.)

Part II.

(*Continued from page 598 of Volume XXV.*)

Order II.—Chiroptera—(*continued.*)

Subfamily II.—Murininæ.

Blanford's genus Harpiocephalus, together with the genus Murina, and a third genus, Harpiola, founded by Thomas (A. M. N. H. (8), xvi., p. 309, 1915) make up this Subfamily, and may be arranged in a key as follows:—

Key to the genera of the Murininæ.

A.—Last upper molar normal.
  a. Canine normal ... ... I. Murina.
  b. Canine not higher than the anterior premolar ... ... II. Harpiola.
B.—Last upper molar reduced to a remnant, often deciduous ... ... III. Harpiocephalus.

Gen. I.—Murina.

No. 198. *tubinaris*, Scully.
No. 201. *cyclotis*, Dobson.
No. 202. *leucogaster*, M.-Edw.

Except that we accept the name *huttoni*, Peters, for the Indian representative of *leucogaster*, these names stand unchanged, but we have to add to the list two new species, *viz.*, *rubex*, Thomas, and *aurata*, Milne-Edwards. These five species may be arranged in a key as follows:—

Key to the species of Murina.

A.—Size small, forearm, 27-35 mm.
  a. Size smaller, forearm 27-28 mm. ... 1. *aurata*, M.-Edw.
  b. Size larger, forearm 33-35 mm.
    a^1. Upper half of outer margin of ear-conch concave... ... 2. *tubinaris*, Scully.
    b^3. Upper half of outer margin of ear-conch convex or straight.

a^2. Colour above ferruginous... 3. *cyclotis*, Dobson.
b^2. Colour above brown ... 4. *huttoni*, Peters.
B.—Size large, forearm 41-42 mm. ... 5. *rubex*, Thomas.

DISTRIBUTION :—

1. *M. aurata*, Milne-Edwards.	*Type locality* :—Thibet. *Other localities* :—Sikkim (B. M.) ; Sikkim (M. S. I.). *Type* :—Paris Museum.
2. **M.** *tubinaris*, Scully.	*Type locality* :—Gilgit. *Other localities* :—"India" (Jerdon) ; Kashmir (B. M.) ; Darjiling ; Chin Hills (M. S. I.). *Type* :—Ind. Mus. Calc.
3. *M. cyclotis*, Dobson.	*Type locality* :—Unknown. *Other localities* :—Sikkim ; Darjiling ; Chin Hills (M. S. I.). *Type* :—Ind. Mus. Calc. No. 166. *a*.
4. *M. huttoni*, Peters.	*Type locality* :—Masuri. (Hutton). *Other localities* :—Darjiling (B. M.); Kumaon (M. S. I.) *Type* :—Unknown.
5. *M. rubex*, Thomas.	*Type locality* :—Pashok, Darjiling. (B. N. H. S.—Baptista). *Other localities* :—None. *Type* :—B. M. No. 16. 2. 25. 111.

Gen. II.—HARPIOLA.

	There is only one species known.
No. 199. *griseus*, Pet.	The type is still the only specimen known.

DISTRIBUTION :—

H. grisea, Peters.	*Type locality* :—Jeripani, Masuri. (Hutton). *Other localities* :—None. *Type* :—B. M. No. 79. 11. 21. 117.

Gen. III.—HARPIOCEPHALUS.

Blanford inserts a " y " in the name without authority.

No. 200. *harpyia*, Temm.	The Indian representative of *harpia*, a Javan bat, is *lasyurus*, Hodgson. It is the only species.

Distribution :—

H. lasyurus, Hodgson. *Type locality* :—Darjiling. (Hodgson).
Other localities :—Darjiling (B. M.) ; Bhutan Duars (M. S. I.).
Type :—B. M. No. 79. 11. 21. 119.

Subfamily III.—Kerivoulinæ.

There is only one genus.

Gen.—Kerivoula.

Blanford adopted the initial "C" without authority.

No. 213. *picta*, Pall.
No. 214. *hardwickii*, Horsf.
No. 215. *papillosa*, Term.

Temminck's species, *papillosa*, is from Java and Sumatra. Blanford mentions a specimen (Mamm. p. 341) which was taken in Calcutta and which he refers to this species, but it has now been examined by Thomas, who separates it as a new species under the name *lenis* (J. B. N. H. S., xxiv., p. 417, 1916) and that name must therefore take the place of *papillosa* for the Indian animal. Early in the Survey I described a new form from Mysore, under the name *crypta* (J. B. N. H. S., xxii., p. 14, 1913). These four forms may be arranged in a key as follows :—

Key to the species of Kerivoula.

A.—Wing-membranes parti-colored orange and black ... ... 1. *picta*, Pall.
B.—Wing-membranes of the same colour throughout.
  a. Size larger, forearm 41 mm. ... 2. *lenis*, Thos.
  b. Size smaller, forearm 35mm. or less.
    a^1. Colour paler ; size greater, forearm 33-35 mm ; ear larger, more markedly emarginate ... ... 3. *hardwickei*, Horsf.
    b^1. Colour darker ; size smaller, forearm 31·5 mm ; ear smaller, less emarginate ... ... 4. *crypta*, Wr.

Distribution :—

1. *K. picta*, Pallas. *Type locality* :—Peninsula of India.
Other localities :—Ceylon (B. M.) ; Western Ghats, Dharwar (M.S.I.)
Co-types :—B. M. Nos. 67. 4. 12. 342-343.
Lectotype :—37. 4. 12. 342.

2. *K. lenis*, Thomas. *Type locality* :—Calcutta.
Other localities :—None.
Type :—B. M. No. 79. 11. 21. 126.

3. *K. hardwickei*, Horsfield. *Type localities* :—Java.
Other localities :—Java (B. M.); Darjiling (M. S. I.).
Type :—B. M. No. 79. 11. 21. 181.

4. *K. crypta*, Wroughton. *Type locality* :—Shimoga, Mysore. (B. N. H. S.—Shortridge).
Other localities :—None.
Type :—B. M. No. 12. 8. 25.2.

Subfamily IV.—MINIOPTERINÆ.

There is only one genus represented.

Gen.—MINIOPTERUS.

No. 216. *schreibersi*, Natt. The Indian representative of the European *schreibersi* is *fuliginosus*, Hodgs., and Dobson has named a species, *pusillus*, from the Nicobars. These two species may be distinguished as follows :—

Key to the species of MINIOPTERUS.

A.—Size larger, forearm more than 45 mm.; hair not extending on to interfemoral membrane ... ... 1. *fuliginosus*, Hodgs.

B.—Size smaller, forearm 40 mm.; hair extending on to interfemoral membrane as far as the third caudal vertebra ... 2. *pusillus*, Dobs.

DISTRIBUTION :—

1. *M. fuliginosus*, Hodgson. *Type locality* :—Nepal (Hodgson)
Other localities :—Western Ghats; Ceylon; Kumaon; Mt. Popa (M. S. I.)
Type :—Not traced.

2. *M. pusillus*, Dobson. *Type locality* :—Nicobars. (Stoliczka).
Other localities :—None.
Type :—Ind. Mus. Calc. No. 185. *dd.*

Family VI.—EMBALLONURIDÆ.

This Family contains three genera which occur within our limits; they may be distinguished as follows :—

Key to the genera of the EMBALLONURIDÆ.

A.—Upper incisors 2-2 ... ... I. EMBALLONURA.
B.—Upper incisors 1-1.
  a. Radio-metacarpal pouch present ... II. TAPHOZOUS.
  b. No radio-metacarpal pouch present. III. SACCOLAIMUS.

Gen. I.—EMBALLONURA.

No. 217. *semicaudata*, Peale.

There is only one species within our limits. This name belongs to a Polynesian species and cannot be used for the Indian animal. Miller established a species, *peninsularis*, from Trong, but Thomas later showed (J. B. N. H. S., xxiii, p. 706, 1915) that it could not be separated from *monticola*, Temm., and that name must therefore be used here.

DISTRIBUTION :—

E. monticola, Temminck.

Type locality :—Java.

Other localities :—Java (B. M.); Tenasserim (M. S. I.)

Type :—Leyden Museum. (Type of *peninsularis*, Miller, U. S. Nat. Mus. No. 83575. (in al.))

Gen. II.—TAPHOZOUS.

No. 218. *melanopogon*, Temm.
No. 219. *theobaldi*, Dobs.
No. 220. *longimanus*, Hardw.
No. 221. *kachhensis*, Dobs.

Thomas has made sub-species, *secatus* and *nudaster*, for the Indian representatives of *theobaldi* and the Burmese form of *kachhensis* respectively (J. B. N. H. S. xxiv., p. 59, 60, 1915) and has recognised the northern form as distinct from *melanopogon*, and identical with *perforatus*, Geoff., from Egypt. These seven forms may be arranged in a key as follows :—

Key to the species of TAPHOZOUS.

A.—No gular sac in either sex.
  a. Abdomen hairy throughout.

a^1. Size smaller, forearm 60-62·5 mm.
a^2. Colour darker; a black beard in males; forearm 62·5 mm. ... 1. *melanopogon*, Temm.
b^2. Colour paler; no black beard in males; forearm 60·5 mm. ... 2. *perforatus*, Geoff.
b^1. Size larger, forearm 71-75 mm.
a^2. Fur extending on to interfemoral membrane ... ... 3. *t. theobaldi*, Dobs.
b^2. Fur not extending on to interfemoral membrane ... ... 4. *t. secatus*, Thos.
b. Lower abdomen naked.
a^1. Fur normal and close ... ... 5. *k. kachhensis*, Dobson.
b^1. Fur exceedingly short and fine ... ... 6. *k. nudaster*, Thos.
B.—A gular sac present in males, rudimentary in females; interfemoral membrane hairy to the exsertion of tail; forearm 60 mm. ... ... 7. *longimanus*, Hardw.

DISTRIBUTION :—

1. *T. melanopogon*, Temminck.	*Type locality* :—Java. *Other localities* :—Khandesh; Secunderabad, Dekhan; Kennery Caves, Salsette; South Konkan; Western Ghats; Malay Peninsula (B. M.); Khandesh; Berars; Nimar; Central Provinces; Kanara; Bellary; Mt. Popa; Tenasserim (M. S. I). *Type* :—Leyden Museum.
2. *T. perforatus*, Geoffroy.	*Type locality* :—Egypt. *Other localities* :—Egypt (B. M.), Cutch; Kathiawar (M. S. I.) *Type* :—Unknown. Perhaps in Paris Museum.
3. *T. theobaldi theobaldi*, Dobs.	*Type locality* :—Tenasserim. (Theobald.) *Other localities* :—None. *Co-types* :—Ind. Mus. Calc. Nos. 187 *a.* & *b.*
4. *T. theobaldi secatus*, Thomas.	*Type locality* :—Asirgarh, Nimar (B. N. H. S.—Crump.) *Other localities* :—Nimar (M.S.I.) *Type* :—B. M. No. 12. 6. 28·5.

5. *T. kachhensis kachhensis*, Dobson.	*Type locality* :—Kachh. (Stoliczka). *Other localities* :—Sind ; Kutch ; Palanpur ; Kathiawar ; Khandesh ; Bellary ; Mysore ; Bengal ; Sikkim (M. S. I.) *Type* :—Ind. Mus. Calc. No. 189. *i.*
6. *T. kachhensis nudaster*, Thomas.	*Type locality* : Pagan, Burma. (B. N. H. S.—Shortridge). *Other localities* :—Pagan, Burma (M. S. I.) *Type* :—B. M. No. 14. 7. 19. 46.
7. *T. longimanus*, Hardwicke.	*Type locality* :—Calcutta. *Other localities* :—Mandvi, Surat Dist. ; Bombay ; Dharwar ; Calcutta; Rangoon (B. M.) Palanpur ; Central Provinces ; Western Ghats ; Kanara ; Bellary ; Mysore ; Bengal ; Chindwin ; Mt. Popa ; Tenasserim (M. S. I.) *Type* :—Unknown. (Type of *brevicaudus*, Blyth, Ind. Mus. Calc. No. 188., *p.* 147).

Gen. III.—SACCOLAIMUS.

No. 222. *saccolæmus*, Temm.	The only representative of the genus in India.

DISTRIBUTION :—

S. saccolaimus, Temminck.	*Type locality* :—Java. *Other localities* :—Java ; Kanara ; (B. M.) Kanara ; Ceylon ; Bengal (M. S. I.) *Type* :—Leyden Museum.

Family VII.—RHINOPOMATIDÆ.

There is only one genus in the Family.

Gen.—RHINOPOMA.

No. 223. *microphyllum*, Geoff. The Indian representative of this species is *hardwickei*, Gray (J. B. N. H. S. xxi., p. 767, 1912.) In the collection from Cutch I named a species, *kinneari* (1. c.), and

Thomas has named a subspecies, *seianum*, of the Arabian *muscatellum* from Seistan (A. M. N. H. (8), xii., p. 88, 1913). These three forms may be arranged in a key as follows :—

Key to the species of RHINOPOMA.

A.—Tail shorter than forearm ; skull with a transverse ridge, on each side, immediately above the nostrils ; forearm 70 mm. ... ... 1. ***kinneari***, Wr.

B.—Tail longer than forearm ; skull with a globular swelling, on each side, above the nostrils.

a. Size larger, forearm 57-61 mm. ... 2. ***hardwickei***, Gray.

b. Size smaller, forearm 52·5 mm. ... 3. ***m. seianum***, Thos.

DISTRIBUTION :

1. *R. kinneari*, Wroughton.	*Type locality* :—Bhuj, Cutch. (B. N. H. S.—Crump.) *Other localities* :—Kathiawar ; Nimar ; Bengal (M. S. I.) *Type* :—B. M. No. 11. 12. 11. 1.
2. *R. hardwickei*, Gray.	*Type locality* :—" India." *Other localities* :—Nasirabad, Rajputana ; Allahabad ; Khandesh ; Dharwar (B. M.) Sind ; Cutch ; Palanpur ; Kathiawar ; Gwalior ; Central Provinces ; Dharwar ; Bellary ; Bengal (M. S. I.) *Type* :—B. M. No. 1. e.
3. *R. muscatellum seianum*, Thomas.	*Type locality* :—Seistan. (Col. MacMahon, Seistan Boundary Commission). *Other localities* :—None. *Type* :—B. M. No. 6. 1. 2. 2.

Family VIII.—MOLOSSIDÆ.

The name TADARIDA has been substituted by Lyon (Proc. Biol. Soc. Wash., xxvii, p. 215, 1914), as being an older name, for NYCTINOMUS. Besides this Thomas recognises two other genera as occurring in our region, and arranges the three genera in a key (J. B. N. H. S., xxii, p. 91, 1913) as follows:—

Key to the genera of the MOLOSSIDÆ.

A.—Premaxillæ separated	I. TADARIDA.
B.—Premaxillæ united.	
a. Basi-occipital pits well defined; a prominent vertical projection on zygoma	II. OTOMOPS.
b. Basi-occipital pits scarcely defined; no projection on zygoma ...	III. CHÆREPHON.

Gen. I.—TADARIDA.

No. 224. ***tragatus***, Dobs. The only species.

DISTRIBUTION :—

T. ***tragata***, Dobson.	*Type locality* :—Calcutta. *Other localities* :—Nasirabad, Rajputana (B. M.); Sind; Cutch; Palanpur; Kathiawar; Dharwar; Mysore (M. S. I.). *Type* :—Ind. Mus. Calc. No. 196. *a.*

Gen. II.—OTOMOPS.

The genus was established by Thomas for the species found by Mr. Prater at Castle Rock, Kanara.

DISTRIBUTION :—

O. ***wroughtoni***, Thomas.	*Type locality* :—Talewadi, Kanara (B. N. H. S.—Prater). *Other localities* :—Kanara (B.M.). *Type* :—B. M. No. 12. 11. 24. 1.

Gen. III.—CHÆREPHON.

No. 225. ***plicatus***, B. Ham. The only species.

DISTRIBUTION :—

C. plicatus, Buchanan Hamilton.	*Type locality*:—Peninsula of India. *Other localities* :—Java; Malay Peninsula; Rajputana (B. M.); Tenasserim (M. S. I.). *Type* :—Unknown.

Order III.—Insectivora.

The following is a key to the four families of this Order, *viz.* :—

A.—Postorbital processes present; orbital ring encircled by bone	I. Tupaiidæ.
B.—Postorbital processes absent.	
a. Crowns of first and second upper molars with a central fifth cusp; bullæ imperfect	II. Erinaceidæ.
b. No central fifth cusp on first and second upper molars.	
a^1. Zygomatic arches present; bullæ ossified	III. Talpidæ.
b^1. No zygomatic arches; bullæ imperfect...	IV. Soricidæ.

Family I.—Tupaiidæ.

Lyon has recently dealt with this Family in an exhaustive monograph (Proc. U. S. Nat. Mus. xiv., p. 1., 1913). He establishes a separate genus for the Peninsular forms occurring west of the River Ganges, and distinguishes the two genera as follows :—

Key to the genera of the Tupaiidæ.

A.—Lower lobe of ear presenting a surface greater than upper half of ear; inner side of ear fairly well haired; reticulations on naked area of nose coarser. ...	I. Anathana.
B.—Lower lobe of ear presenting a smaller surface than upper portion of ear; inner side of ear scantily haired; reticulations on naked area of nose finer.	II. Tupaia.

Gen. I.—Anathana.

No. 101. *ellioti,* Waterh.

Lyon recognises three species which he distinguishes as follows :—

Key to the species of Anathana.

A.—Tail coloured like back; general colour above reddish brown; feet and hind legs buff or ochraceous	1. *ellioti,* Waterh.
B.—Tail coloured differently from the back.	

a. Colour of body above reddish brown; feet and hind legs grizzled buffy ... 2. *pallida*, Lyon.
b. Colour of body above dull grizzled brownish; feet and hind legs grizzled greyish ... ...3. *wroughtoni*, Lyon.

DISTRIBUTION :—

1. *A. ellioti*, Waterhouse.	*Type locality* :—Eastern Ghats, Madras (Elliot.) *Other localities* :—"Madras"(Elliot). (B. M.) *Type* :—B. M. No. 50. 1. 21.5.
2. ***A. pallida***, Lyon.	*Type locality* :—Manbhum, Bengal (Beavan). *Other localities* :—Raipur, Central Provinces. (B. M.) *Type* :—B. M. No. 66.12.28.2.
3. ***A. wroughtoni***, Lyon.	*Type locality* :—Mandvi, Surat. (Wroughton). *Other localities* :—Matheran, Bombay. (B. M.) *Type* :—B.M. No. 96.11.7.1.

Gen. II.—TUPAIA.

No. 102. *ferruginea*, Raff.
No. 103. *nicobarica*, Zeleb.

There appears to be no record of true *ferruginea* with the mammary formula of 2-2=8, within our limits. The Burmese form with three pair of mammæ is undoubtedly *belangeri*, Wagner. Thomas later (A. M. N. H. (8), xiii, p. 243, 1914), suggested that *chinensis*, And., could not be allowed specific rank, but should be treated as a subspecies of *belangeri*; for the Upper Burma form of *belangeri* he provided the subspecific name of *siccata*. Still later, on receipt of the Pegu specimens collected by Mr. Mackenzie, Thomas further established a subspecific name *tenaster* for a southern form of *belangeri*, and a new species, *clarissa*, from Tenasserim. All these forms may be arranged in a key as follows :—

Key to the forms of TUPAIA.

A.—Colour above speckled throughout; a more or less distinct shoulder stripe.
  a. Muzzle not elongated.
    a'. Colour of lower back not essentially different from that of upper.

a^2. Underside buffy ; shoulder stripes indistinct.
  a^3. General colour more tinged with bright yellow ; no dark area at base of tail... ... 1. *b. belangeri*, Wagn.
  b^3. General colour a greenish grey ; a dark area at base of tail ... ... 2. *b. chinensis*, And.
b^2. Underside white ; shoulder stripes white ... ... 3. *b. siccata*, Thos.
b^1. Lower back bright ferruginous as compared with upper ... ... 4. *b. tenaster*, Thos.
b. Muzzle elongated ; colour as in *b. tenaster* ... ... 5. *clarissa*, Thos.
B.—Colour of lower back uniformly blackish ; no shoulder stripes ... ... 6. *nicobarica*, Zel.

DISTRIBUTION :—

1. *T. belangeri belangeri*, Wagner.	*Type locality* :—Rangoon, Burma. *Other localities* :—Rangoon; Tenasserim (B. M.) ; Pegu (M. S. I) *Type* :—Paris Mus. No. 1023.
2. *T. belangeri chinensis*, Anderson.	*Type locality* :—Ponsee, Kakhyen Hills. *Other localities* :—Nepal; Sikkim ; Kachar ; Manipur (B. M.); Sikkim ; Bhutan Duars (M. S. I.). *Co-types* :—Ind. Mus. Calc. Nos. 204. *a*. & *b*.
3. *T. belangeri siccata*, Thomas.	*Type locality* :—Zibugaung Lower Chindwin. (Capt Mears.) *Other localities* :—Mt. Popa (B.M.) ; Chin Hills ; Mt. Popa ; Shan States (M. S. I.). *Type* :—B. M. No. 6.7.5.1.
4. *T. belangeri tenaster*, Thomas.	*Type locality* :—Tagout, Great Tenasserim River. (B. N. H. S.—Shortridge). *Other localities* :—Banlaw; Tenasserim Town ; Tenasserim (M. S. I.). *Type* :—B. M. No. 17.3.25.3.
5. *T. clarissa*, Thomas.	*Type locality* :—Bankachon, S. Tenasserim.(B.N.H.S.—Shortridge). *Other localities* :—Bankasun (B. M.)

Bankachon; Tenasserim Town; Tenasserim (M. S. I.).
Type :—B. M. No. 14.12.8.29.

6. *T. nicobarica*, Zelebor.
Type locality :—Great Nicobar.
Other localities :—None.
Type :—Unknown. Perhaps in Vienna Museum.

Family II.—ERINACEIDÆ.

Blanford distinguishes the two Subfamilies as follows:—

Key to the Subfamilies of the ERINACEIDÆ.

A.—Back and sides covered with spines; tail very short ... ... ERINACEINÆ.
B.—Fur without spines; tail well developed . GYMNURINÆ.

Subfamily I.—ERINACEINÆ.

Thomas has quite recently published (A. M. N. H. (9) I., 1918, p. 193), a study of the ERINACEINÆ in which he has restricted ERINACEUS to the Palæarctic Region from Spain to China, reviving the genera HEMIECHINUS, Fitzinger, and PARÆCHINUS, Trouessart, for our Indian species. These two genera may be distinguished as follows, *viz*:.—

Key to the genera of the ERINACEINÆ.

A.—Spines of the crown coming down evenly on to the forehead ... ... I. HEMIECHINUS.
B.—A parting, bare of spines, running up from the centre of the forehead to the crown ... ...II. PARÆCHINUS.

Gen. I.—HEMIECHINUS.

No. 104. *collaris*, G. & H.
No. 105. *megalotis*, Bly.

A third species of this Genus, viz.:—*grayi*, Bennett, is not recognisable; it is possibly a young specimen of *collaris*.

Key to the species of HEMIECHINUS.

A.—Head and body about 175 mm. long; longest spines about 20 mm. long ... 1. *collaris*, G. & H.
B.—Head and body nearly 300 mm. long; longest spines more than 25 mm. long. 2. *megalotis*, Bly.

DISTRIBUTION :—

1. *H. collaris*, Gray and Hardwicke.	*Type locality* :—Unknown. *Other localities* :—Sind; Multan; Rajputana (B. M.). Sind; Cutch; Palanpur (M. S. I.). *Type* :—Unknown. (*Type* of *spatangus*, Bennett—B. M. No. 55.12.24.34.).
2. *H. megalotis*, Blyth.	*Type locality*:—Kandahar. (Hutton). *Other localities* :—Cabul; Afghanistan; Kandahar (B. M.). *Co-types* :—B. M. No. 79.11.21.515 and 516, and Ind. Mus. Calc. No. 216. *a*. *Lectotype* :—B. M. No. 79.11.21.515.

Gen. II.—PARÆCHINUS.

No. 106. *jerdoni*, And.
No. 107. *pictus*, Stol.
No. 108. *micropus*, Bl.

I published a paper on this group in 1910 (J. B. N. H. S. xx., p. 80). For the reasons there given I arrived at the conclusion that *jerdoni*, And., must give way to *blanfordi*, And. As to *micropus*, Bl., whose allocation is rendered difficult by the extreme confusion in the wording of the paragraph in which it is founded, I took it to be based on Hutton's Bhawalpur specimen, and I propose to continue this determination. The name would therefore take the place of *pictus*, Stol., for the northern hedgehog, while *nudiventris*, Horsf., replaces it for the southern one. This list, as now amended, may be arranged in a key as follows :—

Key to the species of PARÆCHINUS.

A.—Colour dark; second premolar three rooted.
  a. Spines shorter, 20mm. ... ... 1. *blanfordi*, And.
  b. Spines longer, 30mm. ... ... 2. *macracanthus*, Blanf.

B.—Colour pale; second premolar single rooted.
  a. Zygomatic arch complete ... ... 3. *micropus*, Bl.
  b. Zygomatic arch incomplete, malar absent ... ... 4. *nudiventris*, Horsf.

DISTRIBUTION :—

1. *P. blanfordi*, Anderson. *Type locality* :—Rohri, Sind. *Other localities* :—Sind (M. S. I.) *Type* :—B. M. No. 87.4.2.2. (Type of *jerdoni*, Anderson, B. M. No. 87.4.2.1.).
2. *P. macracanthus*, Blanford. *Type locality* :—Mahun, Karman, S. E. Persia. *Other localities* :—Kandahar (B. M.). *Co-types*:—B. M. No. 74.11.21.25. and Ind. Mus. Calc. No. 217. *a*.
3. *P. micropus*, Blyth. *Type locality* :—Bhawalpur. (Hutton). *Other localities* :—Rajputana (B. M.). Sind ; Cutch ; Kathiawar ; Palanpur (M. S. I.). *Type* :—B. M. No. 79.11.21.517. (skull only).
4. *P. nudiventris*, Horsfield. *Type locality* :—" Madras " (Elliot). *Other localities* :—None. *Type* :—B. M. No. 79.11.21.467.

Subfamily II.—GYMNURINÆ.

The two included genera may be distinguished as follows :—

Key to the genera of the GYMNURINÆ.

A.—Larger, head and body more than 200 mm., tail 225 mm. ... ... I. GYMNURA.
B.—Smaller, head and body 125 mm, tail 40 mm. ... ... II. HYLOMYS.

Gen. I.—GYMNURA.

No. 109. *rafflesi*, Horsf.

The older name *gymnura*, Raff, must be revived for this animal. Lyon has separated the smaller northern form under the subspecific name *minor*, and it alone is found within our limits.

DISTRIBUTION :—

G. gymnura minor, Lyon. *Type locality* :—Trong, 2000′, S. W. Siam. (Dr. Abbott). *Other localities* :—Tenasserim (M. S. I.) *Type* :—U. S. Nat. Mus. No. 86783.

Gen. II.—HYLOMYS.

No. 110. *suilla*, Müll. & Schleg.

The generic name HYLOMYS has been revived and generally adopted for the lesser *Gymnura.*

DISTRIBUTION :—

H. suillus, Müller & Schlegel.

Type locality :—Burma.
Other localities:—Burma (B. M.).
Type :—Leyden Museum.

Family III.—TALPIDÆ.

The two genera of this family may be distinguished as follows:—

Key to the genera of the TALPIDÆ.

A.—Upper premolars 4-4 ; tail cylindrical ... I. TALPA.
B.—Upper premolars 3-3 ; tail club-shaped... II. PARASCAPTOR.

Gen. I.—TALPA.

No. 111. *europæa*,
No. 112. *macrura*, Hodgs.

As Blanford points out, there is very grave doubt whether *Talpa europæa*, or as Hodgson named it *macrura*, ever really occurred within our limits. For the present however I retain it.

The two species of this genus may be distinguished as follows :—

Key to the species of TALPA.

A.—Tail cylindrical, long, 30 mm. or more. . 1. *macrura*, Hodgs.
B.—Tail completely concealed by fur, short, 5 mm. or less ... ... 2. *micrura*, Hodgs.

DISTRIBUTION :—

1. *T. macrura*, Hodgson.

Type locality :—Darjiling. (Hodgson).
Other localities :—None.
Type :—B. M. No. 90.1.1.19.

2. *T. micrura*, Hodgson.

Type locality :—Darjiling.
Other localities :— Lakhimpur, Assam ; Myitkyina, Upper Burma (B. M.) ; Sikkim ; Darjiling (M. S. 1.).
Type :—B. M. No. 79.11.21.467.

Gen. II.—PARASCAPTOR.

No. 113. *leucura*, Blyth.

The genus PARASCAPTOR has been revived for this species.

DISTRIBUTION :—

P. leucurus, Blyth.

Type locality :—Cherrapunji, Assam.
Other localities :—Khasia Hills; Noa Dihung (Godwin-Austen) (B. M.).
Type :—Ind. Mus. Calc. No. 227.d.

Family IV.—SORICIDÆ.

The genera of this Family may be arranged in a key as follows :—

Key to the family of the SORICIDÆ.

A.—Teeth tipped brown.	
a. Upper teeth 18	I. SORICULUS.
b. Upper teeth 20	II. BLARINELLA.
B.—Teeth entirely white.	
a. Tail without fringe of white hairs, terrestrial.	
a'. Ear-conch and tail well developed.	
a^2. 18 teeth in upper jaw.	
a^3. Tail naked at the tip; claws compressed, and much elongated	III. FEROCULUS.
b^3. Tail haired to the tip; claws normal	IV. PACHYURA.
b^2. 16 teeth in upper jaw	V. CROCIDURA.
b'. Ear-conch small; tail very short; 14 teeth in upper jaw	VI. ANOUROSOREX.
b. Tail with a fringe of white hairs.	
a'. Ear-conch well developed	VII. CHIMARROGALE.
b' Ear-conch absent	VIII. NECTOGALE.

Gen. I.—SORICULUS.

No. 114. *nigrescens*, Gray.
No. 115. *caudatus*, Hodgs.
No. 116. *macrurus*, Hodgs.

Hodgson gave a number of names in this genus, without any descriptions. Some of these were later published by Horsfield, with short descriptions; the responsibility for the names therefore rests with Horsfield. In this way he described *caudatus* and *leucops*. Blanford assumed *leucops* to be a synonym of *caudatus* and revived and described Hodgson's name *macrurus*, but *leucops* being the older must stand for the species. Thomas recently (J. B. N. H. S. xxii., p. 683, 1914,) described *baileyi*. These four species may be arranged in a key as follows:—

Key to the species of SORICULUS.

A.—Second upper incisor smaller than third; tail short, about 40-45 mm. 1. *nigrescens*, Gray.
B.—Second upper incisor longer than third.
  a. Tail short, about 60-65 mm. ... 2. *caudatus*, Hodgs.
  b. Tail longer.
    a'. Tail about 85-90 mm. ... ... 3. *leucops*, Horsf.
    b'. Tail about 76 mm. ... ... 4. *baileyi*, Thos.

DISTRIBUTION:—

1. *S. nigrescens*, Gray.	*Type locality*:—"Himalaya." *Other localities*:—Bhutan (B. M.). Kumaon; Sikkim; Darjiling (M.S.I.) *Type*:—B. M. No. 42.4.29.65. (Type of *sikimensis*, Horsf., B. M. No. 79.11.21.482.)
2. *S. caudatus*, Horsfield.	*Type locality*:—Nepal. (Hodgson). *Other localities*:—Kumaon; Sikkim; Darjiling (M. S. I.) *Co-types*:—B. M. Nos. 79.11.21. 479 and 480. (Type of *gracilicauda*, Anderson, Ind. Mus. Calc. No. 250. *b*.). *Lectotype*:—B M. No. 79. 11. 21. 479.
3. *S. leucops*, Horsfield.	*Type locality*:—Nepal. (Hodgson). *Other localities*:—Nepal (B. M.). Sikkim (M. S. I.) *Type*:—B. M. No. 79.11.21.483. (Type of *macrurus*, Blanf B. M. No. 90.1.1.19.)
4. *S. baileyi*, Thomas.	*Type locality*:—Tsu River, 7,500', Mishmi Hills, Assam. (Bailey). *Other localities*:—None. *Type*:—B. M. No. 14.1.1.1.

Gen. II.—BLARINELLA.

B. wardi, Thomas.	Thomas established the genus to receive a Chinese form, and later (A. M. N. H. (8), xv., p. 335., 1915), referred the present species to it.

DISTRIBUTION :—

B. wardi, Thomas. *Type locality* :—Hpimau, 8000'. Upper Burma. (O. Thomas—F. K. Ward).
Other localities :—None.
Type :—B. M. No. 15.2.1.3.

Gen. III.—FEROCULUS

The genus was established by Kelaart for the very aberrant form he had already named *feroculus* (*Sorex*).

No. 119. *macropus*, Bl.

Blanford adopts Blyth's name, but as it was not given until a year after the animal had been called *feroculus*, by Kelaart, it must give place to that name.

DISTRIBUTION :—

F. feroculus, Kelaart. *Type locality* :—Newera Eliya, Ceylon. (Kelaart).
Other localities :—None.
Type :—B. M. No. 52.5.9.36. (Type of *macropus*, Blyth, the same specimen.).

Gen. IV.—PACHYURA.

No. 117. *murina*, L.
No. 118. *caerulea*, Kerr.
No. 120. *bidiana*, And.
No. 121. *rubicunda*, And.
No. 122. *leucogenys*, Dobs.
No. 123. *davi*, Dobs.
No. 124. *hodgsoni*, Jord.
No. 125. *perrotteti*, Duv.

Gen. V.—CROCIDURA.

No. 126. *fuliginosa*, Bl.
No. 127. *horsfieldi*, Tomes.
No. 128. *fumigata*, De Fil.
No. 129. *aranea*, L.

These two genera form a most difficult group, and one that, though it has not been comprehensively worked, has had so many names sporadically assigned to it, that the difficult task of thoroughly working it out has been rendered still more arduous. Mr. Hinton had undertaken to work out our Survey material, but circumstances have been too strong for us and the work has not yet even been begun. For the present, I think, and Mr. Thomas agrees with me, that the group had better be left alone in this Summary. Blanford lists 22 species of which 4 are CROCIDURA, but double that number of names already exist for the PACHYURA alone.

Gen. VI.—ANOUROSOREX.

No. 130. *assamensis*, And. Thomas pointed out (J. B. N. H. S., xxiv., p. 766, 1916), that there appears to be no difference between *assamensis*, And., and *squamipes*, M.-Edw.

DISTRIBUTION :—

A. squamipes, Milne-Edwards.	*Type locality* :—Moupin, Sze-chuen. *Other localities* :—Sze-chuen (B. M.); Chin Hills (M. S. I.). *Type* :—Paris Museum. (Co-types of *assamensis*, Anderson, Ind. Mus. Calc. Nos. 278. *a* to *e*.).

Gen. VII.—CHIMARROGALE.

No. 131. ***himalayica***, Gray.

DISTRIBUTION :—

*C. **himalayica***, Gray.	*Type locality* :—" Himalaya". *Other localities* :—Kashmir; Sikkim (B. M.); Sikkim; Darjiling (M. S. I.) *Type* :—B. M. No. 42.2.18.1.

Gen. VIII.—NECTOGALE.

No. 132. ***elegans***. M-Edw. This name was given to a Chinese animal. Later de Winton suggested (P. Z. S. p. 573, 1899) the name *sikhimensis* for the Indian form.

DISTRIBUTION :—

N. sikhimensis, de Winton. *Type locality* :—Lathong, 10,000′, Sikkim. (Waddell).
Other localities :—Thibet; Sikkim, Thibet (B. M.); Sikkim (M. S. I.)
Type :—B. M. No. 96.1.1.9.

Order IV.—DERMOPTERA.

Blanford uses the generic name GALEOPITHECUS, but Thomas, who dealt with the group names in this Order in 1908 (A. M. N. H. (8) I., p. 252), recognized two generic names, relegating GALEOPITHECUS to the Philippine group, not represented in India. The other genus, GALEOPTERUS, was taken by the Survey in Tenasserim.

Gen.—GALEOPTERUS.

No. 133. *volans*, L. This name was given by Linnæus to a Philippine form and Thomas' name *peninsulæ* must be used for our animal.

DISTRIBUTION :—

G. peninsulæ, Thomas. *Type locality* :—Samangko Pass, Malay Peninsula. (H. C. Robinson).
Other localities :—Malay Peninsula (B. M.). Tenasserim (M. S. I.).
Type :—B. M. No. 8.7.20.10.

Order V.—CARNIVORA.

The families of the CARNIVORA may be arranged in a key as follows :—

Key to the families of the CARNIVORA.

A.—Bullæ much dilated, rounded, and (except in HYÆNIDÆ) divided into two chambers by a septum.
  a. Head short; 3 or 4 teeth in upper molar series; claws curved, sharp and retractile; toes 5-4 ... ... I. FELIDÆ
  b. Head elongate.
    a′. Claws variable; 5 or 6 teeth in molar series of each jaw; usually toes 5-5 ... ... II. VIVERRIDÆ

b'. Claws blunt, not retractile; 5 teeth in upper molar series, 4 in lower; toes 4-4 ... ... III. Hyænidæ.
B.—Bullæ much dilated, rounded but not divided ... ... IV. Canidæ.
C.—Bullæ not rounded nor divided.
a. True molars 1-1 in upper jaw, 2-2 in lower; no alisphenoid canal ... V. Mustelidæ.
b. True molars 2-2-in upper jaw: an alisphenoid canal present.
a'. True molars 2-2 in lower jaw ... VI. Procyonidæ.
b'. True molars 3-3 in lower jaw ... VII. Ursidæ.

Family I.—Felidæ.

The two genera included in this Family may be distinguished as follows:—

Key to the genera of the Felidæ.

A.—Claws perfectly retractile; inner cusp of upper sectorial well developed... I. Felis.
B.—Claws imperfectly retractile; inner cusp of upper sectorial rudimentary II. Acinonyx.

Gen. I.—Felis.

No. 28. *leo*, L.
No. 29. *tigris*, L.
No. 30. *pardus*, L.
No. 31. *uncia*, Schreber.
No. 32. *nebulosa*, Griffith.
No. 33. *marmorata*, Martin.
No. 34. *temmincki*, Vigors and Horsfield.
No. 35. *viverrina*, Bennett.
No. 36. *bengalensis*, Kerr.
No. 37. *rubiginosa*, I. Geoffroy.
No. 38. *manul*, Pallas.
No. 39. *ornata*, Gray.
No. 40. *torquata*, F. Cuvier.
No. 41. *chaus*, Güldenstadt.
No. 42. *caracal*, Güldenstadt.
No. 43. *lynx*, L.

Numerous divisions have been proposed in the first three species as established by Linnæus, but none have received general recognition. Blyth has established the name *isabellina* for the Indian form of the *Lynx*, and de Winton, who studied the group, has accepted Gray's name of *affinis* for the Indian representative of *chaus*, on the ground of "its longer tail, bright fox-red ears, and lighter build", its narrower skull and slighter teeth, (A. M. N. H. (7). ii. p. 292, 1898). Blanford's key, modified to this extent, is as follows:—

Key to the species of Felis.

A.—Ears of moderate length, not tufted.
a. Very large, total length over eight feet.

a^1. Tawny throughout; tail tufted at tip. 1. *leo.* L.
b^1. Transversely striped; tail not tufted.. 2. *tigris*, L.
b. Smaller, total length less than 7·5 feet.
a^1. Spotted throughout.
a^2. Markings on body less than 2 inches in diameter.
a^3. Exceeding 5 feet from nose to tail-tip ... ... 3. *pardus*, L.
b^3. Less than 5 feet from nose to tail-tip.
a^4. Tail about one fourth the length of head and body together ... ... 4. *viverrina*, Benn.
b^4. Tail about one third the length of head and body together.
a^5. No distinct longitudinal bands on crown; ears pointed... ... ... 5. *ornata*, Gray.
b^5. Distinct longitudinal bands on crown; ears rounded.
a^6. Upper molar series 3 on each side; tail unspotted ... ... 6. *rubiginosa*, Geoff.

b^6. Upper molar series 4 on each side; tail spotted above ... ... 7. *bengalensis*, Kerr.
b^2. Markings on body exceeding 2 inches in diameter, or becoming irregular blotches.
a^3. Large; pale grey or whitish with dark rings on body ... ... 8. *uncia*, Schreb.
b^3. Brownish grey or tawny, with large irregular blotches or irregular black bands.
a^4. Total length from nose to tail-tip over 5 feet in adults ... 9. *nebulosa*, Griff.
b^4. Total length under 5 feet ...10. *marmorata*, Mart.
b^1. Uniformly coloured, or with more or less indistinct transverse bands; size moderate or small.
a^2. Size larger, total length 45—50 inches; colour chestnut above; tail whitish below ... ...11. *temmincki*, Vig. & H.

b^2. Size smaller, total length 30—35 inches.
  a^3. Paler, silvery grey or buff; fur long, thick and soft ... ...12. *manul*, Pall.
  b^3. Darker, grey or tawny.
    a^4. Backs of ears coloured ochraceous... ... ...13. *affinis*, Gray.
    b^4. Backs of ears coloured like the body .. ..14. *torquata* F. Cuv.

B.—Ears long, pointed, with a tuft at the tip.
  a. Tail about one-fourth of total length ...15. *caracal*, Güld.
  b. Tail less than one-fifth of total length . 16. *isabellina*, Blyth.

DISTRIBUTION :—

1. *F. leo*, L.	*Type locality* :—Africa. *Other localities* :—Junagadh ; Kathiawar (B. M.). *Type* :—Unknown. (Type of *guzeratensis*, Smee, B. M. No. 55. 12. 24. 432.)
2. *F. tigris*, L.	*Type locality* :—Asia. *Other localities*:–(Generally throughout Indian region). *Type* :—Unknown.
3. *F. pardus*, L.	*Type locality* :—Egypt. *Other localities*:–(Generally throughout Indian region). *Type* :—Unknown.
4. *F. viverrina*, Bennett.	*Type locality* :—Madras Presidency (Heath). *Other localities* :—Mirpur, Sind ; Kandy, Ceylon ; Nepal (B. M.); Eastern Province, Ceylon (M. S. I.). *Type* :—B. M. No. 55. 12. 22. 252.
5. *F. ornata*, Gray.	*Type locality* :—Rajputana (Boys). *Other localities* :—Thar and Parkar, Sind ; Sehore, Central India (B. M.) ; Sind ; Cutch ; Kathiawar (M. S. I.). *Type* :—B. M. No. 48. 8. 14. 3.
6. *F. rubiginosa*, Geoffroy.	*Type locality* :—Pondicheri, Madras. *Other localities* :—Nellore, Madras, (B. M.) ; Central Province, Ceylon (M. S. I.). *Type* :—Perhaps in Paris Museum.

7. ***F. bengalensis***, Kerr.	*Type locality* :—"Bengal." *Other localities* :—S. Beluchistan; Coorg; Simla; Punjab; Kumaon; Nepal; Lakhimpur, Assam; Bengal; Tenasserim; Malay Peninsula (B. M.); Kumaon; Lachung, 8,800'; Chungtang, 5,350'; Darjiling 3,500'; Sikkim; Chin Hills; E. Manipur; Upper Chindwin; Thayetmyo, Ruby Mines, (Maymyo, Upper Burma; Mergui; Tenasserim M. S. I.). *Type* :—Unknown. (Type of *ellioti*, Gray, B. M No. 168. *a.*; Type of *wagati*, Gray, B. M. No. 192. *a.*; Type of *tenasserimensis*, Gray, B. M. No. 44. 3. 25. 285).
8. ***F. uncia***, Schreber.	*Type locality* :— Unknown. *Other localities* :—Ladak; Thibet (B. M.). *Type* :—Unknown.
9. ***F. nebulosa***, Griffith.	*Type locality* :—Sumatra. *Other localities* :—Nepal; Sikkim; Bhamo, Upper Burma (B. M.) *Type* :—Unknown. (Type of *macroceloides*, Hodgson, B. M. No. 45. 1. 8. 211.)
10. ***F. marmorata***, Martin.	*Type locality* :—"Java or Sumatra." *Other localities* :—Nepal (B. M.) *Type* :—B. M. No. 55. 12. 29. 254 (Type of *charltoni*, Gray, B. M. No. 46. 3. 4. 6.)
11. ***F. temmincki***, Vigors and Horsfield.	*Type locality* :—Sumatra. *Other localities* :—Nepal; Sikkim; Upper Chindwin; Malay Peninsula (B. M.); N. Shan States (M. S. I). *Type* :—B. M. No. 55. 12. 24 240.
12. ***F. manul***, Pallas.	*Type locality* :—Central Asia. *Other localities* :—Kandahar (Blanford); Ladak (Strachey); Thibet; "Kirgisen," India (B.M). *Type* :—Unknown.
13. ***F. affinis***, Gray.	*Type locality* :—Gangutri, Kumaon. *Other localities* :—Seistan; Rajputana; Sehore, Central India; United Provinces; Poona, Bombay; She-

varoy Hills, Madras ; Colombo, Ceylon ; Nepal ; Assam (B. M.); Upper Sind Frontier; Mt. Abu, Rajputana; Palanpur, Kathiawar ; Cutch ; Khandesh ; Nimar ; Central Provinces ; Dharwar ; Kanara ; Coorg ; N. Province, Ceylon ; Kumaon ; Behar ; Orissa ; Midnapur, Bengal (Topotype of *kutas*, Pearson) ; Bhutan Duars ; Chin Hills ; Lower Chindwin ; Mt. Popa, Upper Burma (M. S. I.).

Type :—B. M. No. 57. 6. 10. 40. (Lectotype of *erythrotus*, Hodgs, B. M. No. 43. 1. 12. 6.).

14. *F. torquata*, F. Cuvier.

Type locality :—Nepal.

Other localities :—Rajputana ; Kumaon (B. M.); Junagadh and Rajkot; Kathiawar (M. S. I.)

Type :—Perhaps in Paris Museum.

15. *F. caracal*, Güldenstadt.

Type locality :—Caspian Sea.

Other localities :—Baluchistan ; Sind (B. M.); Cutch (M. S. I.)

Type :—Unknown.

16. *F. isabellina*, Blyth.

Type locality :—Thibet.

Other localities :—Gilgit ; Kashmir ; Thibet (B. M.)

Co-types :—Ind. Mus. Calc. Nos. *e.* & *f.* of Sclater's Catalogue.

Gen. II.—ACINONYX.

Hollister pointed out in 1911 (Proc. Biol. Soc. Wash. xxiv. p. 225). that CYNAILURUS, the name adopted for this genus by Blanford, was established by Wagler in 1830, whereas Brookes used (Anat. Zool. Mus., p. 16.), ACINONYX in 1828.

No. 44, *jubatus*, Schreber.

Hollister further noted (l. c.) that this name belonged to the African form, and that the earliest name for the Indian "cheetah" is *venaticus*, Gray, (Griffith's Cuv. v., p. 166, 1827).

DISTRIBUTION :—

A. venaticus, Gray.

Type locality :—"India". The species was founded on a picture by

Hamilton Smith, which was probably based on an animal from Mysore.

Other localities:—Except one mounted for exhibition, presented by the Zoological Society, the National Collection has no specimen of this animal, and none has been obtained by the Mammal Survey.

Type:—Unknown.

Family II.—Viverridæ.

The two Subfamilies of Viverridæ may be distinguished as follows:—

Key to the Subfamilies of Viverridæ.

A.—Claws strongly curved, more or less retractile; prescrotal glands usually present ... ... I. Viverrinæ.
B.—Claws lengthened, exserted, not retractile; no prescrotal glands ... II. Mungotinæ.

Subfamily I.—Viverrinæ.

Gray's division of the genus Paradoxurus into two has now been generally accepted; the name Arctogalidia has been substituted for Arctogale, this latter being preoccupied; the genus Hemigalus, taken for the first time within our limits, has to be added. Blanford's key of the Subfamily may be modified as follows:—

Key to the genera of the Viverrinæ.

A.—Ears not tufted; tail not prehensile.
  a. Tarsus and metatarsus hairy behind; tail with dark and light rings.
    a^1. Two upper true molars; a black gorget.
      a^2. An erectile black dorsal crest ... I. Viverra.
      b^2. No crest ... ... II. Viverricula.
    b^1. One upper true molar; no gorget... III. Prionodon.
  b. Tarsus partly naked.
    a^1. Sole naked nearly to the heel; tail not ringed.
      a^2. Teeth large; a preanal or prescrotal glandular tract.
        a^3. Bony palate not extending a quarter of an inch behind the last upper molars ... ... IV. Paradoxurus.

b^3. Bony palate extending more than half an inch behind the last upper molars ... V. PAGUMA.
b^2. Teeth small; no naked preanal or prescrotal tract ... ... VI. ARCTOGALIDIA.
b^1. Sole at most half naked, tail ringed. VII. HEMIGALUS.
B.—Ears tufted; tail prehensile; tarsus naked behind ... ...VIII. ARCTICTIS.

Gen. I.—VIVERRA.

No. 45. *zibetha*, L.
No. 46. *civettina*, Blyth.
No. 47. *megaspila*, Blyth.

Two names were recently given by myself (J. B. N. H. S. xxxiv, p. 64, 1915) to local forms of *zibetha*. Further material seems to show that one of these, *picta*, cannot be maintained; the other, *pruinosa*, has to be added to the marginal list. The four forms may be arranged in a key as follows:—

Key to the forms of VIVERRA.

A.—No black stripe down the upper side of the tail.
  a. A general fulvous tinge, due to the buff tips of all the hairs ... 1. *z. zibetha*, L.
  b. General colour a clear grey, due to the white tips of all the hairs ... 2. *pruinosa*, Wrought.
B.—A black line down upper side of tail.
  a. Large transverse dark marks on sides 3. *civettina*, Blyth.
  b. All spots, no transverse marks ... 4. *megaspila*, Blyth.

DISTRIBUTION :—

1. *V. zibetha zibetha*, Linnæus.	*Type locality* :—Bengal (Thomas, P. Z. S., p. 137, 1911). *Other localities*:—Nepal (B. M.); Sikkim; Darjiling; Bhutan Duars; Chin Hills; Lower Chindwin (M.S.I.). *Type* :—Unknown. (Lectotype of *melanura*, Hodgs. B. N. No. 43. 1. 12. 25; type of *civettoides*, Hodgs. B. M. No. 43. 1. 12. 25).
2. *V. zibetha pruinosa*, Wroughton.	*Type locality* :—Tenasserim (B. N. H. S.—Shortridge). *Other localities*:—Siam; Malay Peninsula (B. M.); Tenasserim; Shan States (M. S. I.). *Type* :—B. M. No. 14.12.8.106.

3. *V. civettina*, Blyth. *Type locality* :—South Malabar.
Other localities :—None.
Type :—Ind. Mus. Calc. (*b.* of Sclater's Catalogue).

4. *V. megaspila*, Blyth. *Type locality* :—Prome, Lower Burma.
Other localities:—Chindwin; Mt. Popa; Tenasserim (M. S. I.)
Type :—Lost.

Gen. II.—VIVERRICULA.

No. 48. *malaccensis*, Gmel. Almost all authors have remarked on the variability of this animal, but though several different races have been described I have entirely failed so far in finding one that seems valid.

DISTRIBUTION :—

V. malaccensis, Gmelin. *Type locality* :—" in Indiis ".
Other localities :—Dagshai, Punjab; Rajputana; Nepal; Assam; Central Provinces; Dharwar; N. Malabar; Madras; Ceylon; Upper Burma, Pegu; Malay Peninsula (B.M.); Sind; Cutch; Palanpur; Kathiawar; Satara; Dharwar; Coorg; Kumaon; Bengal; (topotypes of *bengalensis*; Gray); Sikkim; Bhutan Duars; Chin Hills; Chindwin; Mt. Popa; Tenasserim (M.S.I.).
Type :—Unknown. (B.M. No. 85. 8.1.27. type of subspecies *deserti*, Bonh.).

Gen. III.—PRIONODON.

No. 49. *pardicolor*, Hodgs.
No. 50. *maculosus*, Blanf. There seems no necessity for any change in these names. Blanford distinguishes the two species as follows :—

Key to the species of PRIONODON.

A.—Smaller, head and body about 15 inches; back with longitudinal rows of large dark spots ... ... 1. *pardicolor*, Hodgs.

B.—Larger, head and body 18 or 20 inches;
back with broad transverse bands ... 2. *maculosus*, Blanf.

DISTRIBUTION :—

1. *P. pardicolor*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities*: Sikkim (B.M. and M.S.I.). *Co-types* :—B. M. Nos. 43.1.12.10 and 11. *Lectotype* :—B.M. No. 43.1.12.11.
2. *P. maculosus*, Blanford.	*Type locality* :—Bankachon, Tenasserim. (Hume—Davison). *Other localities* :—Malay Peninsula (B.M.) *Co-types*:—B.M. Nos. 85. 8. 1. 28 and 83.10.24.1. *Lectotype* :—B. M. No. 85. 8. 1. 28.

Gen. IV.—PARADOXURUS.

Blanford in his key of the genus places *grayi* in a section, "B", by itself on account of the shape of the palate. Mainly for the same reason it is now generally recognised as belonging to a distinct genus, PAGUMA.

No. 51. *niger*, Desm.
No. 52. *hermaphroditus*.

Blanford, with the exception of *aureus*, Ceylon, and *jerdoni*, Malabar, both of which are well marked special forms, ranges all the Indian toddy-cats in these two species. I have recently reviewed the nomenclature of this genus (J.B.N.H.S. Vol. XXV, p. 48, 1917), and for reasons there recorded I decided that the Indian Toddy-cats formed three species represented by the names *crossi*, Gray, *niger*, Desmarest, and *strictus*, Horsfield; while, the Burmese form not having a name, I suggested for it that of *birmanicus*. In 1914 Miller gave the name of *ravus* to the form from

Trong, which apparently is found at any rate in S. Tenasserim.

No. 53. *aureus*, F. Cuv.
No. 54. *jerdoni*, Blanf.

There seems no reason for any change in these two well marked species. The following may be substituted for Blanford's key to the genus, *viz.*:—

Key to the species of PARADOXURUS.

A.—Pattern of dark markings on a pale ground.	
a. Back and sides not, or only obscurely, striped and spotted	1. *crossi*, Gray.
b. Back and sides distinctly striped and spotted.	
a^1. Smaller, hindfoot 75-80 mm., greatest length of skull 105-110 mm.; ground colour grey	2. *niger*, Desmarest.
b^1. Larger, hindfoot 80-90 mm., greatest length of skull 115-120 mm.	
a^2. Ground colour fulvous ...	3. *strictus*, Horsfield.
b^2. Ground colour dull or buffy white.	
a^3. Crown of head black ...	4. *birmanicus*, Wrought.
b^3. No black crown	5. *ravus*, Miller.
B.—Pattern a uniform colour.	
a. General colour dull rusty red ...	6. *aureus*, F. Cuvier.
b. General colour dark brown	7. *jerdoni*, Blanf.

DISTRIBUTION :—

1. *P. crossi*, Gray.

Type locality :—Unknown. (menagerie specimen).

Other localities :—Nepal; Dekhan (Sykes); Central India; Rajputana (B. M.); Rohilkund (M. S. I.)

Type :—B. M. No. 78 *a.* (Type of *hirsutus*, Hodgson B. M. No. 43. 1.12.119.; Type of *nigrifrons*, Gray, B. M. No. 42. 10. 5. 2.)

2. *P. niger*, F. Cuv.

Type locality :—Pondicheri.

Other localities :—Madras (Jerdon); Ceylon (B. M.) Satara; Dharwar; Kanara; Mysore; Coorg (M. S. I.).

Type :—Perhaps in Paris Mus. (Type of *pallasi*, Gray B. M. No. 55. 12. 24. 230. ; Type of *nictitatans*, Taylor, B. M. No. 92. 7. 28. 1.).

3. *P. strictus*, Horsfield.

Type locality :—Nepal (Hodgson).

Other localities :—Assam (B. M.) ; Darjiling; Bhutan Duars (M. S. I.).

Type : –B. M. No. 79. 11. 21. 546. (Type of *quadriscriptus*, Horsfield, B. M. No. 79. 11. 21. 542 ; Type of *vicinus*, Schwartz, B. M. No. 79.11.21.283).

4. *P. birmanicus*, Wroughton.

Type locality :—Mingun, Upper Burma (B. N. H. S.—Shortridge).

Other localities :—Tonghoo ; S. W. Siam (B. M.). ; Lower Chindwin Shan States ; Mt. Popa (M. S. I.).

Type :– B. M. No. 14. 7. 19. 89.

5. *P. ravus*, Miller.

Type locality :—Trong, Lower Siam. (Abbott).

Other localities :—Lower Pegu (B. M). ; Tenasserim (M. S. I.)

Type :—U. S. Nat. Mus. No 84429.

6. *P. aureus*, F. Cuvier.

Type locality :—Ceylon.

Other localities :—Newera Eliya, Ceylon (Kelaart) (B. M.). ; Kala Oya, Ceylon (M. S. I.).

Type :—Perhaps in Paris Museum.

7. *P. jerdoni*, Blanford.

Type locality :—Hills of Malabar.

Other localities :—Travancore ; Anamalai Hills ; Nilgiri Hills (B. M.) ; Coorg (M. S. I.).

Type :—B. M. No. 88. 9. 26. 2.

Gen. V.—PAGUMA.

No. 55. *grayi*, Benn.

As pointed out above, under PARADOXURUS, this genus contains the section " B" of Blanford's key to that genus, *i.e.*, the species *grayi*, Benn., of which *nipalensis* and *lanigera* are synonyms, and of which Schwartz has separated

(A. M. N. H. (8) xii., p. 289, 1913), a western subspecies under the name *wroughtoni*. Besides this, however, a species *leucomystax*, Gray, inhabiting the Malay Peninsula and southwards, is now found to extend its range northwards, in a slightly modified form to which Miller has given (Proc. Biol. Soc. Wash., xix., p. 26, 1906) the subspecific name *robusta*. A Chinese form, from Yunnan, *viz.* :—*larvata*, Temm., similarly extends within the border of northern Burma and to this form I have given (J. B. N. H. S. xix., p. 793, 1910), the subspecific name of *intrudens*. Finally Tytler has described a form from the Andamans (J. A. S. B. xxxiii., p. 188, 1864), under the name *tytleri*. These forms may be arranged in a key as follows:—

Key to the forms of PAGUMA.

A.—Hair, short (20-25 mm.) and harsh ... 1. *tytleri*, Tytl.
B.—Hair, long (35-40 mm.) and silky.
  a. Median pale face stripe not produced beyond the forehead backwards ... 2. *leuc. robusta*, Mill.
  b. Median pale face stripe produced backwards on to crown.
    a^1. Median, pale face stripe not produced backwards on to the nape.
      a^2. Paler; head and neck not markedly darker than rest of body. 3. *grayi grayi*, Benn.
      b^2. Darker; head and neck markedly darker than rest of body ... 4. *grayi wroughtoni*, Schw.
    b^1. Median pale face stripe produced backwards on to the nape ... 5. *larv. intrudens*, Wr.

DISTRIBUTION:—

1. *P. tytleri*, Tytler.	*Type locality* :—Andamans. (Tytler.) *Other localities* :—Rutland Island, Andamans (B. M.). *Co-types* : – Ind. Mus. Calc. Nos. *l. m. n. p. q.*
2. *P. leucomystax robusta*, Miller.	*Type locality* :—Trong, Lower Siam. (Abbott). *Other localities* :—Bankachon, Tenasserim (M. S. I.). *Type* :—U. S. Nat. Mus. No. 86796.

3. *P. grayi grayi*, Bennett.	*Type locality* :—" India." *Other localities* :—Nepal (B. M.); Kumaon, 9,000′; Darjiling 2,000′; Chin Hills (M. S. I.) *Type* :—B. M. No. 55.12.24.232. (Type of *lanigera*, Hodgson, B. M. No. 43. 1. 12. 103; Type of *nipalensis*, Hodgson, B. M. No. 45. 1. 8. 297).
4. *P. grayi wroughtoni*, Schwartz.	*Type locality* :—Gharial. Punjab. (Dunn). *Other localities* :—Simla, Punjab; Kashmir (B. M.). *Type*:—B. M. No. 7. 11. 21. 11.
5. *P. larvata intrudens*, Wroughton.	*Type locality* :—Myitkyina, Upper Burma. (Capt. A. W. Kemmis.) *Other localities* :—Yunnan, China (B. M.) Northern Shan States (M. S. I.). *Type* :—B. M. No. 9.7.20.6.

Gen. VI.—ARCTOGALIDIA.

The name ARCTOGALE was first used by Kaup in 1829 (Entw) Gesch. Nat. Syst. Eur. Thierwelt. ii, p. 30.) for a genus of MUSTELIDÆ, and Merriam substituted (Science, v., p. 302, 1897) for it the name of ARCTOGALIDIA in its present connexion.

No. 56. *leucotis*, Horsf.	The only species.

DISTRIBUTION :—

A. leucotis, Horsfield.	*Type locality* :—Tenasserim. *Other localities* :—Lower Siam; Malay Peninsula (B. M.); Tenasserim Village (M. S. I.). *Type* :—B. M. No. 79.11.21.545.

Gen. VII.—HEMIGALUS.

Thomas has pointed out (J. B. N. H. S. xxiii., p. 612, 1915), that the animal usually known as *Hemigale hardwickei*, must in future be called *Hemigalus derbianus*, Gray. Blanford does not mention the genus at all, for it had not, in his day, been found within our limits. The Survey having now obtained specimens from Tenasserim, only slightly differing from typical *derbianus*, Thomas has supplied the subspecific name (1. c. p. 613) *incursor*.

DISTRIBUTION :—

H. derbianus incursor, Thomas.	*Type locality* :—Bankachon, S. Tenasserim. (B. N. H. S.—Shortridge.) *Other localities* :—None. *Type* :—B. M. No. 14.12.8.115.

Gen. VIII.—ARCTICTIS.

No. 57. *binturong*, Raff.

Thomas has named a new species from S. W. Siam (A. M. N. H. (8), xvii, p. 270, 1916), under the name *gairdneri*, which will very probably be found to extend into our limits. These two forms may be distinguished as follows :—

Key to the species of ARCTICTIS.

A.—Size large, greatest length of skull, 153 mm. ... ... 1. *gairdneri*, Thos.
B.—Size small, greatest length of skull, 136 mm. ... ... 2. *binturong*, Raff.

DISTRIBUTION :—

1. *A. gairdneri*, Thomas.	*Type locality* :—Sai Yoke, S. W. Siam. (Gairdner.) *Other localities* :—S. W. Siam (B. M.) *Type* :—B. M. No. 15.12.1.26.
2. *A. binturong*, Raffles.	*Type locality* :—Sumatra. (Raffles.) *Other localities* :—Upper Burma (B. M.) Tenasserim (M. S. I.) *Type* :—Unknown.

Subfamily II.—MUNGOTINÆ.

Gen.—MUNGOS.

The name used by Blanford, HERPESTES, for this genus dates only from 1811, whereas Geoffroy and Cuvier used the name MUNGOS fifteen years earlier (Mag. Encycl. ii., p. 184, 1795).

No. 58. *auropunctatus*, Hodgs.
No. 59. *birmanicus*, Thos.

The form *persicus*, Gray, included in the synonymy of *auropunctatus* by Blanford does not, so far as I have been able to discover, occur within our limits, but *pallipes* is a well marked form of the Kandahar border. Miss Ryley described (J. B. N. H. S. xxii., p. 661,1914) another local race, under the name *helvns*, from Deesa, Gujerath. Quite recently I recorded that the type of *nipalensis*, Gray, had been found (J. B. N. H. S. xxv., p. 68, 1917).

No. 60. *mungo*, Gmel.

I gave a very full synonymy of this species, when it was first obtained by the Survey (J. B. N. H. S. xxi., p. 401, 1912). One name only out of all those recorded, *i.e.*, *ferrugineus*, requires to be revived to represent the race of *mungo* from the extreme north of India. Miss Ryley added the name *pallens* (J. B. N. H. S. xxii., p. 660 1914) for the Gujerath form. Since then I have had occasion to provide two more Subspecific names, *mœrens* and *ellioti* (for the Nimar and Dharwar forms respectively), and to make a new species, *lanka*, for the Ceylon form (J. B. N. H. S. xxiv., p. 50, 1915).

No. 61. *smithi*, Gray.
No. 62. *fuscus*, Waterh.
No. 63. *fulvescens*, Kel.
No. 64. *vitticollis*, Benn.
No. 65. *urva*, Hodgs.

These five species make up the remainder of Blanford's key. The only change required in any of them is pointed out by Miss Ryley in her Report on South Ceylon (J. B. N. H. S. xxii., p. 706, 1914), where she substitutes *flavidens* for *fulvescens*, Kelaart having used the former name in 1850 (J. R. A. S. Ceyl. ii., p. 323), though the reference was overlooked by Blanford. These may be arranged in a key as follows:—

Key to the species of MUNGOS.

A.—No neck-stripe.
  a. No black tail-tip.
    a^1. Fur close and short, longer hairs of back with 4 or 5 rings of colour; size, small.
      a^2. Hindfoot, without claws, less than two inches long.
        a^3. Pattern very coarse.
          a^4. Darker, dark brown ... 1. *auropunctatus* Hodgs.

b^4. Paler, buff.

a^5. Ground colour cream buff ... ... 2. *aur. helvus*, Ryl.

b^5. Ground colour white... 3. *aur. pallipes*, Bl.

b^3. Pattern very fine ... ... 4. *nipalensis*, Gray.

b^2. Hindfoot, without claws, more than two inches long ... ... 5. *birmanicus*, Thos.

b. Fur longer, long hairs of back with more than 5 rings; size, larger.

a^2. Naked sole extending to heel.

a^3. Pattern of grizzle, coarser.

a^4. Face, feet, and tail-tip coloured strongly ferruginous ... ... 6. *mungo ferrugineus*, Bl.

b^4. Face, feet, and tail-tip not or only slightly coloured ferruginous.

a^5. Face, feet, and tail noticeably but not strongly ferruginous.

a^6. Under fur buff... 7. *mungo mungo*, Gmel.

b^6. Under fur white. 8. *pallens*, Ryl.

b^5. Ferruginous colouring of face, feet and tail-tip almost or entirely absent.

a^6. Under fur greyish-white ... 9. *mungo mœrens*, Wr.

b^6. Under fur buff... 10. *mungo ellioti*, Wr.

b^3. Pattern of grizzle very fine... 11. *lanka*, Wr.

b^2. Naked sole not extending to heel.

a^3. Size large, tarsus and hindfoot about three inches; colour dark brown grizzle... 12. *fuscus*, Waterh.

b^3. Size smaller, tarsus and hindfoot less than 2·7 inches; colour dark brown or rufous. 13. *flavidens*, Kel.

b. A black tail-tip ... ... 14. *smithi*, Gray.

B.—A neck-stripe.

a. Neck-stripe black; a black tail-tip... 15. *vitticollis*, Benn.

b. Neck-stripe white; no black tail-tip.. 16. *urva*, Hodgs.

DISTRIBUTION :—

1.	*M. auropunctatus*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities* :—Kashmir; Orissa; Kuch Behar (B.M.); Bhutan Duars (M. S. I.) *Co-types* :—B. M. No. 43.1.12.20. & 22. *Lectotype* :—B. M. No. 43.1.12.20.
2.	*M. auropunctatus helvus*, Ryley.	*Type locality* :—Deesa, Guzerath (B. N. H. S.—Crump). *Other localities* :—Palanpur, Gwalior State; Bengal (M. S. I.) *Type* :—B. M. No. 13.8.23.1.
3.	*M. auropunctatus pallipes*, Blyth.	*Type locality* :—Kandahar. *Other localities* :—Seistan; Sukkur and Larkana, Sind (B. M.); Khairpur, Sind Frontier (M. S. I.) *Type* :—Unknown.
4.	*M. nipalensis*, Gray.	*Type locality* :—"North India". *Other localities* :—Midnapur, Bengal, (M. S. I.) *Type* :—B. M. No. 43.5.31.18.
5.	*M. birmanicus*, Thomas.	*Type locality* :—Pegu (Oates). *Other localities* :—Manipur; Cachar (B. M.); Pegu (M. S. I.) *Type* :—B. M. No. No. 81.12. 2.4.
6.	*M. mungo ferrugineus*, Blanford.	*Type locality* :—Larkhana, Sind. *Other localities* :—Rohri, Sind; Kohat, N. E. Provinces (B. M.); Khairpur State and Sukkur, Sind (M. S. I.). *Type* :—Indian Museum, Calcutta, No. ?
7.	*M. mungo mungo*, Gmelin.	*Type locality* :—"Hab. in Bengala, Persia, aliisque Asiæ callidioribus plagis." *Other localities* :—Nepal (B. M.); Gwalior State; Central Provinces; Ramnagar, Kumaon; Jalpaiguri, Bengal; Bhutan Duars; Daltongunj, Behar (M. S. I.). *Type* :—Unknown. (Co-types of *nyula*, Hodgs. B. M. Nos. 43.1.12.17. 18.19. Lectotype B. M. No. 43.1.12. 18.

8.	*M. mungo pallens*, Ryley.	*Type locality*:—Palanpur, Guzerath (B. N. H. S.—Crump). *Other localities*:—Hazara; Sambhar; Rajputana; Jodhpur State (B. M.); Mt. Abu, Rajputana; Danta State; Guzerath; Cutch State; Philibhit; Rohilkund (M. S. I.). *Type*:—B. M. No. 13.8.23.2.
9.	*M. mungo mærens*, Wroughton.	*Type locality*:—Ganoor, Nimar. (B. N. H. S.—Crump). *Other localities*:—Cutch; Junagadh State: Khandesh; Berar; Hoshangabad; Central Provinces (M. S. I.) *Type*:—B. M. No. 12.6.28.14.
10.	*M. mungo ellioti*, Wroughton.	*Type locality*:—Dharwar (B.N.H.S.—Shortridge). *Other localities*:—North Kanara; "Madras" (Jerdon); Trevandrum, Travancore (B. M.), Seringapatam South Mysore; South Coorg (M. S. I.). *Type*:—B. M. No. 12 6.29.44.
11.	*M. lanka*, Wroughton.	*Type locality*:—Cheddikulam, N. P., Ceylon (B. N. H. S.—Mayor). *Other localities*:—Ceylon (Colombo Museum) (B. M.); Tammanewa; Ceylon (M. S. I.) *Type*:—B. M. No. 15.3.1.54.
12.	*M. fuscus*, Waterhouse.	*Type locality*:—"India." *Other localities*:—"Madras" (Jerdon); Trevandrum, Travancore (B. M.); South Coorg (M. S. I.). *Type*:—B. M. No. 55.12.24. 227.
13.	*M. flavidens*, Kelaart.	*Type locality*:—Central Ceylon. (Kelaart). *Other localities*:—Kandy (B. M.); Central Province, & Uva, Ceylon (M. S. I.). *Type*:—Ind. Mus. Calc. No. *a* ?
14.	*M. smithi*, Gray.	*Type locality*:—Unknown. *Other localities*:—Sambhar, Rajputana; Shevaroy Hills, Madras; "Madras" (Jerdon); Kandy, Ceylon (B. M.); Mt. Abu, Rajputana; Hoshangabad, Central Provinces;

	Satara; Mankeni and Ranna, Ceylon (M. S. I.) *Type*:—B. M. No. 38.12.13.1. (Co-types of *jerdoni*, Gray, B. M. Nos. 46.11.6.21 and 46.11.9.5. Lectotype, B. M. No. 46.11.9.5.).
15. *M. vitticollis*, Bennett.	*Type locality*:—Travancore. *Other localities*:—Dharwar (Elliot); Nilgiri Hills, Ceylon (B. M.), Coorg (M. S. I.) *Type*:—B. M. No. 55.12.24.224.
16. *M. urva*, Hodgson.	*Type locality*:—Central and North Nepal. *Other localities*:—Sadya, Assam; Upper Chindwin; Tharawaddy and Rangoon, Burma (B. M.); Kanara; Darjiling (M. S. I.). *Co-types*:—B. M. Nos. 43.1.12.31, 32 and 33. *Lectotype*:—B. M. No. 43.1.12.33.

Family III.—HYÆNIDÆ.

Gen.—HYÆNA.

No. 66. *striata*, Zimm. Thomas pointed out in 1911 (P. Z. S. p. 134), that *hyæna*, L., must be substituted for *striata*. There is not only not enough material from India, but still more there is none to join up the Indian region with the type locality.

DISTRIBUTION:—

H. hyæna, Linnæus.	*Type locality*:—The Benna Mountains, Bunder Abbas, Persian Gulf. *Other localities*:—Khairpur, Sind; Cutch; Khandesh; Nimar; Central Provinces; Kumaon; Orissa (M.S.I.). *Type*:—Unknown.

(To be continued.)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY

No. XVIII.

REPORT ON THE HOUSE RATS OF INDIA, BURMA, AND CEYLON.

BY

MARTIN A. C. HINTON.

At the request of the Bombay Natural History Society, I undertook the comparison of the House Rats collected by the Mammal Survey with the Indian material in the British Museum. The work proved to be a complex and difficult task, but I have now reached three chief conclusions, namely:—(1) That the common Indian House Rat, which in the various Survey Reports has been listed either as "*Epimys rufescens*" or else as "*E. rufescens*, var. with white underparts," is indistinguishable specifically from *Rattus*[1] *rattus*, Linnæus; (2) that this species shows in India, Burma and Ceylon, a definite geographical variation, so that many races or subspecies have now to be recognized; and (3) that the forms described as *R. nitidus* and *R. vicerex*, about the status of which there has been much controversy, are entitled to full specific rank, although they, too, are members of the *R. rattus* group.

In this paper *R. rattus*, as represented in the Mammal Survey collections, is dealt with exhaustively; and *R. nitidus* receives sufficient treatment to enable me to define a very interesting subspecies from the Chin Hills. With regard to *R. vicerex*, I must for the present content myself with publishing some skull measurements.

In presenting my results to the Society I am fully conscious of the fact that there is still plenty of room for further work upon these very difficult and somewhat unattractive animals. To obtain definite results one needs long series of careful measurements, external and cranial, accompanied by careful notes on the colour and mammae, from as many districts as possible. As a basis for further research I have given my original tables of skull measurements, with a description of the method of making them, at the end of this paper. If observers, dwelling in comparatively remote districts, could be induced to furnish us with corresponding data, each dealing with say 100 fully adult rats from his own district and carefully studied by himself, our knowledge of the geographical variation and its systematic value would very quickly be placed upon a secure foundation.

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[1] As pointed out by Hollister (*P. Biol. Soc. Washington*, XXIX, p. 126, 1916), *Rattus* (misprinted *Ruttus*), Fischer (*Das National Museum der Naturgeschichte zu Paris.* Frankfurt au Main, 1803, Bd. II, p. 128), is a valid generic name and must replace *Epimys*, Trouessart (1880). This is unfortunate but quite unavoidable. I would take this opportunity of expressing my agreement with Thomas's statement that Fischer took *R. rattus* as the type of his genus, and not "*decumanus*" (*norvegicus*) as asserted by Hollister.

Key to Indian, Cinghalese, & Burmese members of the group based principally upon external characters) :---

I. Tail bi-coloured ... ... *Rattus vicerex*, Bonhote.
II. Tail unicoloured.
  A. Fur very fine ; lacking all trace of bristles. Nasal length exceeding 40 per cent. of the condylo-basal length of skull.
    a. Tail longer, about 108 per cent. of length of head and body. Fur long and thick ; underparts silvery or hoary. *Rattus nitidus nitidus*, Hodgson.
    b. Tail scarcely longer than head and body. Fur short and thin ; underparts not silvery, frequently with rusty tinge ... *Rattus nitidus obsoletus*, Hinton.
  B. Fur coarser, usually with many bristles (though these vary in strength). Nasals usually less than 40 per cent. of the condylo-basal length of the skull.
    a. Ventral fur white to bases ; lateral line of demarcation usually well defined.
    a^1 Mammæ normally 3-3=12.
      a^2 Pectoral mammæ not undergoing reduction.
        a^3 Tail relatively short, averaging less than 120 per cent. of the head and body length.
          a^4 Dorsal colour dull greyish brown ; audital bullæ very large ... *R. rattus tatkonensis*, Hinton.
          b^4 Dorsal colour with an ochreous tinge ; audital bullæ medium sized... *R. rattus khyensis*, Hinton.

b^3 Tail relatively long, averaging more than 120 per cent. of the head and body length.

a^4 Fur of underparts long and soft. Dorsal colour cold grey or yellow ... ... *R. rattus gangutrianus*, Hinton.

b^4 Ventral fur shorter and harsher.

a^5 Dorsal colour black, grizzled with tawny. *Rattus macmillani*, Hinton.

b Dorsal colour rich dark olive brown ... *R. rattus sikkimensis*, Hinton.

b^2 Pectoral mammæ undergoing reduction. Tail short, averaging about 108 per cent. of head and body length. Dorsal colour umber ... *R. rattus tikos*, Hinton.

b Mammæ normally 2-3=10

a^2 Fur full; dorsal colour warm and bright. Tail length variable.

a^3 Dorsal colour olive brown.

a^4 Size larger (H. & B. averaging 145; HF. 32); tail shorter, about 123 per cent. of head and body length ... *R. rattus tistæ*, Hinton.

b^4 Size smaller (H. & B. averaging 137; HF. 31); tail longer, about 131 per cent. of head and body length ... *R. rattus bhotia*, Hinton.

b^3 Dorsal colour not olive brown.

a^4 Backs bright clay or golden brown; tail very long, more than 150 per cent. of head and body length ... *R. rattus sataræ*, Hinton.

b^4 Backs inclining to rufous; whitish bristles usually present.

a^5 Tail shorter, about 122 per cent. of head and body length ... *R. r. wroughtoni*, Hinton.

b^5 Tail longer, about 132 per cent. of head and body length ... ... *R. r. kandianus*, Kelaart.

b^2 Fur rather short, thin and harsh, but usually not spiny; dorsal colour cold and dull; tail long, about 135 per cent. of head and body length.

a^3 Dorsal colour warmer, near cinnamon brown or tawny ... ... *R. rattus arboreus*, Buch.—Ham.

b^3 Dorsal colour colder and greyish.

a^4 Dorsal colour drab; long black hairs tending to form a mid-dorsal stripe... ... *R. rattus narbadæ*, Hinton.

b^4 Dorsal colour drab grey; mid-dorsal line decidedly darkened by black hairs; white of belly duller ... ... *R. rattus girensis*, Hinton.

b. Ventral fur slaty based; no sharp line of demarcation along flanks.

a^1 Fur long, dense, and soft; ventral fur white tipped; tail short, less than 120 per cent. of head and body length ... ... *Rattus kelaarti*, Wroughton.

b^1 Fur thinner and harsher; ventral fur not white tipped;

tail long, more than 120 per cent. of head and body length.	
a^2 Dorsal colour rufous; hair of belly rough with rusty tinge	*R. rattus rufescens*, Gray. *R. rattus nemoralis*, Blyth.
b^2. Dorsal colour rarely rufous; bellies without rusty tinge.	
a^3. Backs grey or brown; belly light grey to dusky, rough or smooth	*R. rattus alexandrinus*, Geoff.
b^3. Back black; belly bluish grey, sleek haired	*R. rattus rattus*, Linnæus.

1. *Rattus rattus*, Linnæus.

A brief reference to the history of this species in Europe will greatly facilitate both the presentation and the understanding of the Indian facts. *Mus rattus*, Linnæus (*Syst. Nat.*, 10th ed., 1758, p. 61), was described from Upsala, Sweden, and based upon the well known Black Rat. At or a little before the date when Linnæus wrote, this animal was the common house rat of Europe, but later it was almost completely replaced by the Brown Rat (*R. norvegicus*, Berkenhout). Typical *R. rattus* is characterized externally by its dusky coloration, its back being usually black and its underparts of a dark brownish grey or slate. In 1803, Geoffroy (*Cat. Mamm. Mus. Nat. d' Hist. Nat. Paris*, p. 192) named his *Mus alexandrinus* from Alexandria, Egypt; and in 1812, he gave a full description and figure (*Descr. de l'Égypte, Hist. Nat.* II., p. 735; Atlas Pl. V, fig. 1). From the latter account it is evident that *Mus alexandrinus* is a rat in which the back is buffy brown, this colour brightening gradually on the flanks to pass insensibly into the whitish or yellowish grey of the underparts. In 1814, Rafinesque (*Préc. des Decouv. et Trav. Somiologiques*, p. 13) described his "*Musculus frugivorus*", from Sicily; and in 1825, Savi (*Nuovo Giorn. dei Letterati*, Pisa, X, p. 74) re-described the same form from Pisa, Italy, under the name of *Mus tectorum*. This Sicilian and Italian rat is brown above as in *alexandrinus*, but it possesses a softer coat, and the fur of its underparts is of a pure white or lemon yellow colour, separated on each side from the rich tint of the flanks by a sharp line of demarcation.

In 1866, de l'Isle (*Ann. Sc. Nat.* (*Zool.*) IV, p. 173) described a series of breeding experiments which he had made with "*Mus rattus*" and "*Mus alexandrinus*"; by the latter name Rafinesque's *frugivorus* and not Geoffroy's *alexandrinus* seems to have been implied. Among the progeny of the various crosses effected, were some peculiar rats which de l'Isle called "*semialexandrines*"; judging from the description these must have corresponded rather closely with Geoffroy's *alexandrinus* in outward appearance. De l'Isle demonstrated that *rattus*, *frugivorus*, and *alexandrinus* are nothing but colour phases of one and the same species, *viz.*, *R. rattus*, Linnæus. His experiments suggested that the wild-coloured *frugivorus* represents the primitive stock, properly belonging to warm temperate or sub-tropical regions; and that the dusky coloration of typical *rattus* is simply a change of hue brought about by the indoor life forced upon the species by its successful endeavours to colonize colder lands. The species appears to have made its way to north-western Europe at about the time of the Crusaders; and by the 16th century, at the latest, it had fully assumed there its familiar dusky garb. Geoffroy's *alexandrinus* may be regarded as an intermediate stage, the belly having acquired within doors a darker colour, and having lost its sharp contrast with the flank tint, although dorsal darkening has not taken place to any considerable extent. In examining a large, cosmopolitan collection of rats, it is quite easy to find and arrange a series of individuals connecting *frugivorus* with *alexandrinus*, and especially the latter form with typical *rattus*.

Mendelians, as Bonhote (*P.Z.S.*, 1910, p. 653 and 1912, p. 6), argue that these three forms of *rattus* have arisen as mutations. There is nothing inconsistent between this view and the history of typical *rattus* as outlined above. In any case the colour differentiation in the three races is susceptible of a physiological explanation.

Recently the three European races have been treated as subspecies, the characters of which may be tabulated as follows:—

A.—Dorsal parts black.
  Ventral parts dusky; the hairs on belly short and usually adpressed ... ... *R. rattus rattus*, Linn.

B.—Dorsal parts brown.
  a. Ventral parts not usually conspicuously lighter than flanks; ventral hairs with slaty bases; coat harsh and usually thin ... ... *R. rattus alexandrinus*, Geoff.
  b. Ventral parts light coloured, sharply contrasted with flanks; ventral hairs

mostly pure white or lemon coloured to their bases; coat soft and usually thick... ... ... *R. rattus frugivorus*, Raf.

Specimens intergrading in appearance between these subspecies usually come from colonies of mixed origin, *e.g.*, those of ships or of large towns. Where opportunities for pure breeding occur, as on small islands, each of these subspecies breeds perfectly true to type. It is, of course, unfortunate that the typical form of the species, in a technical sense, is *R. r. rattus* (which is little better than a domestic animal), and not the really wild form, *R. r. frugivorus*.

Turning now to India, the rats listed in the Survey Reports as "*rufescens*", or "*rufescens* var.", afford us with problems of considerable complexity. In the first place, although I am unable to find any character in the dentition, skull, or external parts, to distinguish any of them satisfactorily from *R. rattus*, the range of variation is enormous. Indian skulls with well worn teeth have the condylo-basal length ranging between 34 and 44 mm. The fur may be long, soft, dense and without spines; or it may be short, thin, and harsh, with numerous spiny bristles. The dorsal colour varies between bright rufous, or warm olivaceous tints on the one hand, to dull tawny, or cold mixtures of black and grey on the other. The underparts may be pure white or pale lemon; or they may be slaty, with or without a rusty tinge or bloom. The hands and feet may be white or yellowish above, with or without dusky markings; or they may be wholly blackish brown in colour. The mammary formula may be 2-3=10 or 3-3=12. Every intermediate stage between the extremes indicated may be found in the collections before me. Nevertheless, much of this variation has a definite geographical value; and where long series are available from one locality or district, the rats are usually found to conform closely to one or more definite local types. It is therefore possible to define a considerable number of local races or subspecies.

The members of the *rattus* group seem to afford an exception to the rule, so general for wild mammals, that not more than one subspecies of a given species, or not more than one of two or more very closely allied species can inhabit a given locality. But these rats are capable of playing many parts in warm countries; thus we find them following a free life in fields and hedgerows, far from houses, or high up among the branches of trees in forests; or they may lead a purely parasitic existence in human habitations or shelters. It is a poor sort of locality which refuses at least two "niches in nature" for *rattus*; and the semi-domesticated stocks, at all events, of this species have frequent opportunities for prospecting and touring conferred upon them by railways, wheeled carriages, and shipping.

Like other murines, this species shows, within certain limits, an almost startling plasticity. Its structure responds readily to the demands of purely local requirements. If necessary colour or the quality of the coat are modified; a change in diet induces modifications in the development or the "set" of the muscles of mastication; and these in turn mould the skull, or lead to the lengthening or shortening of the tooth-rows.

Considerations such as those mentioned in the preceding paragraphs lead us to realize the hopelessness of attempting to disentangle the history of the rats in large towns or ports like Calcutta or Bombay. In such places the rat population is a motley horde, representing the progeny of truly native rats crossed with the descendants of old wanderers and with newcomers not only from the neighbouring hinterland but from all parts of the world. It is therefore only in the more remote parts of the country that we can reasonably expect some measure of success to crown such efforts.

The material collected by the Mammal Survey is most extensive, and although gaps exist it is now possible to gain a broad idea of the chief facts relating to the distribution and variation of the present species in India. Save for the conclusion that *R. nitidus* in entitled to full specific rank, the conclusions of this paper are little more than natural extensions of those reached by Thomas in 1881, upon the basis of comparatively insignificant material.

In North-Western India, Sind and the Punjab, the prevalent race seems to be identical with *R. r. alexandrinus.* Further east, from the Himalayan districts of Kumaon and Sikkim southwards to Travancore and Ceylon, and through Assam and Burma to South Tenasserim, the common rat is that called "var. *rufescens*" by Thomas and Blanford. This is, however, split into a number of local races. The most striking and widespread variations are those to which attention has so frequently been drawn in the Reports, *viz.*, a dark bellied variety and a variety with pure white underparts. Mr. Wroughton has already commented upon the remarkable distribution of these two types (Report No. 15, *J. B. N. H. S.*, Vol. XXIII, p. 295).

At the higher collecting stations in Kumaon only white bellied specimens were found; at some lower stations white and dark bellied rats were present together in apparently equal numbers; while at still lower elevations dark bellied rats alone occurred. Again in Sikkim and at Hasimara, Bhutan Duars, all are of the white bellied type, although a certain proportion have slaty bases to their ventral hairs. In Bengal and Orissa, and in the southern part of the peninsula as at Travancore, as well as through Assam, Burma, and Tenasserim, the rats are uniformly of the white-bellied type. From South

Coorg northwards along the Western Ghats in Mysore; in the Central Provinces and in Kathiawar, the white-bellied type is present but accompanied by rats of the dark bellied type. In Cutch, Palanpur, Gwalior, Nimar, Western Khandesh, Berars and Bellary, only dark bellied rats were collected. Similar facts were noted by Major Lloyd, and he tells us that of many thousands examined from the Punjab only some few from three villages in the Amritsar and Lahore districts were of the light bellied type (Rec. Ind. Mus. III, p. 20).

Such distributional facts viewed in gross appear at first sight to afford the strongest possible evidence in support of the idea that white bellied and dark bellied types belong to distinct subspecies if not species. The initial object of my work, indeed, was to test such a belief.

Mr. Wroughton has already brought before the Society (*J. B. N. H. S.*, Vol. XXIII, p. 474) the view that the white bellied forms of *R. rattus* in India and Burma represent the primitive wild form of the species; and that the dark bellied types are parasites, the darkening of the underparts, no less than the darkening of the back, being the outward indication of domesticity or parasitism. In support of this view, one may point to the general similarity of the Indian white bellied forms to the wild race, *R. r. frugivorus*, of the Mediterranean region; to their wide distribution, both in the mountains and in the plains, in India and Burma: and to the wild life which many of them lead in the jungles. Further on investigating these white bellied rats in detail, we find that they behave very much as do normal wild mammals as regards geographical variation and that it is therefore possible and comparatively easy to arrange them in geographical races or subspecies.

With regard to the dark bellied rats the case is different. They are largely restricted to districts possessing substantial houses; they are more frequently caught within doors and far less frequently in the open. Close investigation of their structure leads to nothing but confusion; the variation is largely individual or colonial, and scarcely at all geographical. In some districts, as in Kumaon, such rats seem to have little or no connection with the white bellied forms; in other places, they differ from their white bellied companions merely in colour and to a trifling extent in skull—the cranial differences being readily susceptible of a physiological explanation, as is shown below in discussing the rats of the Central Provinces and Kathiawar; finally, in still other districts, the difference is purely one of colour and even that sometimes breaks down. One concludes from this that the dark bellied rats are of diverse origin; some seem to have been produced, in the localities where they are now found, from the local white bellied race; others have found their way to their present habitations from other more or less remote districts of the country, or even from abroad; and lastly, many are doubtless to be regarded as the mixed descendants of both native and imported stocks.

1. *Rattus rattus tistæ*, subsp. n.

1916. *Epimys rufescens*, variety with white underparts, Wroughton, Report No. 23, Sikkim and Bengal Terai, *J. Bombay Nat. Hist. Soc.*, Vol. xxiv, p. 489 (in part).

Type.—A female (B. M. No. 17·7·2·13; Original No. 393) collected at Pashok, Sikkim, by N. A. Baptista on 16th July 1915; presented to the National Collection by the Bombay Nat. His. Soc.

Distribution.— Sikkim.

Material examined. –122 (60 ♂, 62 ♀), from Pashok (3,500′); 14 (7 ♂, 7 ♀), from Narbong (2,000′); 7 (3 ♂, 4 ♀), from Rongli (2,700′); 1 ♂ from Gopaldhara (4,720′); 3 (1 ♂, 2 ♀) from Batasia, Tonglu (6,000′); 3 (1 ♂, 2 ♀) from Gangtok (6,000′); and 4 (2 ♂, 2 ♀) from Sedonchen (6,500′). Total 154 (75 ♂ 79 ♀).

Description.—The *fur* is soft and thick, without spines on the back; and not particularly long on the underparts. In the typical series from Pashok the backs are dark olive-brown and very uniform in *colour*. The ventral colouration is of two types; in about a third of the specimens from the type locality the ventral hairs have slaty bases and light tips and in these specimens a suffusion of buff, recalling what is seen in many forms of *Apodemus*, is sometimes present, forming a median thoracic stripe and occasionally even a pectoral collar. In many other specimens, however, the ventral hairs are white from their tips to their bases; while in others pure white and slaty-based hairs occur together in variable proportions. The mammary formula of females appears to be constantly 2-3 = 10.

The following are the collector's measurements * of those specimens from Pashok whose skulls were specially investigated ventral hairs:—

No. 288	♂,	3rd	July	1915,	145—168—31—21	slaty bases.
,, 325	♂,	8th	,,	.,	161—194—32—22	slaty bases.
,, 625	♂,	18th	Aug.	.,	160—183—33—23	slaty bases.
., 234	♀,	27th	June	,	158—180—32—23	intermediate.
., 243	♀,	28th	,,	.,	150—180—31—22	intermediate.
., 335	♀,	9th	July	..	153—180—30—22	pure white.
,, 393	♀,	16th	..	,,	155—196—32—21	do. type.
., 414	♀,	19th	.,	,,	135—169—32—21	slaty bases.
,, 482	♀,	27th	,,	,,	149— —32—22	pure white.
,, 689	♀,	3rd	Sept.	,,	138— —31—21	slaty bases.

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* These dimensions are:—(1) Head and body. (2) Tail, without terminal hair. (3) Hindfoot, without claws. (4) Ear from base.

The following are averages (absolute and percentages of the head and body length) of specimens in adult pelage, of both sexes and all from Pashok:—

(1) Average of 31 (Head and body ranging between 122 and 161) *with slaty bases* to the ventral hairs =

143—174—32·1—21 = 100—122—22·5—14·7.

(2) Average of 81 (Head and body ranging between 120 and 171) comprising *intermediate* specimens as well as those with *pure white* ventral hairs =

147—181—32·1—21·3 = 100—124—21·8—14·5.

(3) Average of 50 10-mammæd females (ventral coloration of both types) = 144—177—31·5—20·9 = 100—123—21·9—14·5.

(4) Average of 40 white-bellied females (a few not included in the total of average 3, because their mammæ could not be counted on the skins) = 145—179—31·4—21 = 100—123—21·6—14·5.

In no female did the length of the head and body exceed 161 mm. Larger individuals were not only always males, but were all of the pure white-bellied type; I suspect that some of these really belong to *R. r. sikkimensis* (described below), for without examining the skulls[*] it is sometimes difficult to discriminate between the males of that sub-species and those of the white-bellied phase of the present form.

The following table shows the decreasing values of the average relative lengths of the tail, hind-feet and ears in *R. r. tistæ* at successive stages of growth; for systematic purposes it is instructive to compare it with the similar table given latter for the associated *R. r. sikkimensis*:—

PASHOK.

R. r. tistæ.			Average length in percentages of Head and Body, H. & B., Tail, Hind-foot, Ear.
Head and body mm.	Sex.	No. of specimens.	
100 to 120	♂ & ♀	14	100—127—26·7 —17·1
121 to 139	♂	12	100—129—24·2 —15·5
Do.	♀	21	100—120—23·4 —15·1
140 to 149	♂	16	100—125—22·4 —14·9
Do.	♀	18	100—125—22·8 —14·4
150 to 159	♂	15	100—129—21·3 —14·1
Do.	♀	15	100—119—20·9 —14
160	♀	1	100—111—20 —13·1
161	♂	2	100—118—20·25—14
160 to 171	♂	10	100—121—20·25—14·8[†]

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[*] It was not possible to clean all the many skulls collected and often the search for the skull of some particularly fine skin revealed the annoying fact that that particclar skull had been smashed by the trap.

[†] As noticed above these large rats are probably in part referable to *R. r. sikkimensis.*

The skull is small (average condylo-basal length between 37·7 and 38·4 mm., *i.e.*, about 2 mm. less than in European races of *R. rattus* or in *R. r. sikkimensis*), and therefore the cranial width appears relatively great, showing an increase equal to from 1 to 1·7 per cent. of the condylo-basal length (see Table 11). Judging from dimensions 6 and 7, as well as from the relation of the latter to the cranial width, (dimension 3), the temporal muscles are no weaker than in *R. r. alexandrinus.* Posteriorly, even in old skulls, the temporal lines are at a level considerably below the ends of the interparietal; and thus the upper surface of each parietal articulates with the supraoccipital by a conspicuous tongue. The temporal wing of each parietal is small, its length being equal to less than half the distance between the lambdoidal crest and the antero-superior extremity of the squamosal.

In relation to the condylo-basal length, the palatal length, masseteric plate and tooth-rows are distinctly longer, although the nasals, diastema and palatal foramina are about as in European *rattus.* The pterygoid region is short, for while the distance condyle to bulla is about as in *R. r. frugivorus*, condyle to m. *3*, in relation to the condylo-basal length, is about 3 % shorter. The cheek-teeth are as in European *rattus.*

Local variation :—

NARBONG (2,000′).

14 (7 ♂, 7 ♀) collected by Mr. Crump; of these 2 are in the British Museum (Nos. 15, 9, 1, 152-153). The dimensions of the more important are :—

6439 ♂, 10 March 1915, 176—206—35—23, Weight 6 ozs.
·152 6473 ♂, 14 ,, ,, 161—195—34—23
6474 ♂, ,, ,, ,, 165—180—32—22
6479 ♀, 15 ,, ,, 154—176—33—21, Weight 4 ozs
·153 6480 ♀, ,, ,, ,, 156—179—31—24 ,, 4 ,,
6487 ♀, ,, ,, ,, 144—171—31—20 ,, 3 ,,
Average of 14 :— 156—182—32·2-21·7
Do. per cent. of H & B :—100—117—20·7-13·9

10 mammæ are apparent in each of 4 of the female skins.

These rats have rather bright backs and are much like those from Rongli noticed below. In 5 (3 ♂, 2 ♀) the bellies are pure white, although in 4 of these some of the hairs on the chest have slaty bases. In the remainder the majority of the ventral hairs have slaty bases and in some a median stripe of buff is developed on the thorax. The whole series is, however, very uniform really, for even the bellies, despite the differences just noted, appear remarkably similar when viewed from a little distance. Skull as in typical series.

BATASIA, TONGLU (6,000′).

3 (1 ♂, 2 ♀) collected by Mr. Crump (2 in British Museum Nos. 15, 9, 1, 150-151). Dimensions:—

·150 6394 ♂, 25 Feb. 1915, 163—188—35—22, Weight 5 ozs.
6395 ♀, ,, ,, ,, 155—183—35—21 ,, 5 ,,
·151 6411 ♀, 27 ,, ,, 151—206—31—21 ,, 4 ,,

Each female has 10 mammæ. No. 6411 is quite like those from Pashok, but the other two have much brighter yellowish-brown backs, lined with black. In the two registered specimens, the ventral fur is long and soft; certain of the hairs are buff-tipped and form an indistinct median thoracic stripe and pectoral collar; most of these buff-tipped hairs have deep slaty bases, but the dark tint is almost completely hidden by the long light tips. Elsewhere all the ventral hairs, save the usual bright buff ones around the genitalia, are white throughout. In No. 6395, the majority of the ventral hairs have a very pale greyish basal tinge. The feet are ashy grey, with a slight tinge of yellow in the male. The skulls are imperfect but agree apparently with those from Pashok.

RONGLI (2,700′).

7 (3 ♂ 4 ♀) collected by Mr. Crump; of these 4 are now in the British Museum and their dimensions are:—

B. M. 15, 9, 1.
·137 5847 ♂, 24 Nov. 1914, 158—183—34—21, Weight 4½ ozs.
·139 5825 ♀, 22 ,, ,, 156—185—33—21 ,, 4½ ,,
·141 5849 ♀, 25 ,, ,, 153—170—31—21 ,, 4¾ ,,
·142 5850 ♀, ,, ,, ,, 148—167—32—21 ,, 4 ,,

Nos. ·139 and ·141 have each 10 mammæ.

This series is interesting as showing that sometimes the differences in ventral coloration, already alluded to; are apparently co-related with slight differences in the dorsal colour. Thus Nos. 5847 and 5825 have bellies of a pronounced *Apodemus* type, *i.e.*, the ventral hairs have deep slaty bases and a heavy and rather generally distributed suffusion of buff; in these two the backs also are darker than in the following, Nos. 5849 and 5850 have silvery bellies with the ventral hair bases of a distinctly lighter grey than in the first mentioned specimens; their backs have more of the yellowish-brown tints seen in some of the specimens from Gangtok and Batasia. The feet, moreover, are inclined to be lighter in the lighter bellied type. Similar differences are shown by the three unregistered specimens from this locality. The skulls of ·137 and ·141 were measured (Table 1) and apparently agree with those from Pashok.

Sedonchen (6,500′).

4 (2 ♂, 2 ♀), 3 being adult, collected by Mr. Crump. Dimensions:—

5769 ♂, 14 Nov. 1914, 154—178—31—21, Weight 4½ ozs.
5748 ♀, 10 ,, ,, 132—145—30—20 ,, 2¾ ,,
5779 ♀, 15 ,, ,, 140—152—29—19

The first two have the backs yellowish-brown, lined with black; their bellies are whitish, the ventral hairs having deep slaty bases and white tips; their feet have dusky markings above and the tails are dark. No. 5779 has a darker belly and shows a trace of a buff stripe and collar.

Gangtok (6,000′).

3 (1 ♂, 2 ♀,) collected by Mr. Crump; 2 in British Museum (Nos. 15. 9. 1. 143/144). Dimensions:—

·143 5875 ♂, 3 Dec. 1914, 167—191—33—21, Weight 5½ ozs.
·144 5871 ♀, 2 ,, ,, 150—179—31—20
5876 ♀, 3 ,, ,, 140—165—32—22 Weight 3 ozs.

No. ·144 is dark above, while ·143 is yellowish-brown as in the ♂ from Batasia. In the former (·144) a few hairs along the mid-throacic line have buff tips; in the latter (·143) many on the throat and chest are buff-tipped and form a complete collar and median stripe. All the ventral hairs have deep slaty bases and the feet are perhaps a shade darker than in the specimens from Batasia. The skull of ·143 was measured (Table I) and does not appear to differ from those from Pashok.

Gopaldahra (4,720′).

1 ♂ (No. 24) collected by Mr. N. A. Baptista, on 2nd May 1915, differs from the other specimens from this locality, referred below to *R. sikkimensis* in having the bases of the ventral hairs deep slaty. It may perhaps be referred to *R. r. tistæ*. The dimensions of this specimen are:—146—198—32—23.

2. *Rattus rattus bhotia*, subsp. n.

Type:—A male (B. M. No. 17· 7· 2· 20; Original No. 1185), collected at Hazimara, Bhutan Douars, on 26th November 1915, by Mr. N. A. Baptista; presented to the British Museum by the Bombay Natural History Society.

Distribution:—Known only from the type locality.

Material examined:—124 (66 ♂, 58 ♀) collected by Mr. N. A. Baptista between 22nd October 1915 and 13th January 1916.

Description:—This is a soft-furred rat closely resembling *R. r. tistæ* in general appearance. It differs, from the latter subspecies in its smaller size, the hindfoot and ear averaging in 111 adults, 31 and 20·4 instead of 32 and 21·3, respectively; the tail also is relatively longer, averaging in the adults 131 per cent. of the head and body measurement instead of about 123 per cent. Mammary formula constantly 2-3=10.

Taken as a whole the series shows brighter backs than those of typical *R. r. tistæ* from Pashok, the general dorsal colour being a rufous tint near "Brussells brown"; many of the specimens are, however, as dark in hue as any from Pashok. As in *R. r. tistæ* the ventral coloration is of two types; 62 (32 ♂, 30 ♀) have pure white bellies, the ventral hairs being white to their bases; in 18 (15 ♂, 3 ♀) the bellies are white also, but slaty bases are developed by many of the hairs on the chest and throat, forming chest spots or stripes of large size; in 6 (2 ♂, 4 ♀) pure white and slaty-based hairs are equal in number and distribution; lastly in 38 (17 ♂, 21 ♀) practically all the hairs have slaty bases and light tips, and in these specimens a median stripe-like suffusion of buff is sometimes developed. The preponderance of pure-white bellied individuals is therefore as well marked in this subspecies as in the typical series of *R. r. tistæ* from Pashok; and it may be suggested that the two types of ventral coloration in both forms are "mutations" obeying Mendel's law in inheritance.

The following are the dimensions of the specimens whose skulls were specially investigated :—

			Ventral hairs :—
1048 ♂,	3 Nov. 1915,	131—190—33—22,	Intermediate.
1125 ♂,	14 ,, ,,	145—194—33—21,	Pure white.
1140 ♂,	17 ,, ,,	147—184—34—21,	Slaty bases.
1185 ♂,	26 ,, ,,	149—211—33—20	Do.
1208 ♂,	30 ,, ,,	142—200—32—21,	Pure white.
1221 ♂,	3 Dec. ,,	143—184—30—21	Do.
1241 ♂,	7 ,, ,,	141—187—32—21	Do.
980 ♀,	22 Oct. ,,	131—186—34—20,	Intermediate.

Average of 111 adults :—137—179—31—20.4

,, per cent. of H. and B.=100—131—22·6-14.9

The following table shows the changes in the average proportions correlated with growth or larger size and it may be compared with that given at p. 69 above :—

Head and Body. mm.	No. of specimens.	Average % of head & body formed by H. & B. Tail, Hind-foot, Ear.
100 to 120	19	100—133 -25.7—17.1
121 to 139	60	100—132.5-23.4—15.2
140 to 149	36	100—127.5-21.7—14.3
150 to 155	7	100—123 -20.6—14.2

The skull and teeth do not differ from those of *R. r. tistæ* in any important respect.

3. *Rattus rattus arboreus*, Buchanan-Hamilton.

1851. *Mus arboreus*, Buchanan Hamilton in Horsfield, *Cat. Mamm. Mus. E. India Co., London*, 1851, p. 161; described from "Bengal," the type being unknown.

1865. *Mus rufescens*, Blyth, *Cat. Mamm. Mus. As. Soc., Calcutta*, p. 115 (in part); Jerdon (in part).

1881. *Mus alexandrinus*, *a.* typical var., Thomas, *P. Z. S.* 1881, p. 532 (in part).

In a portion of his MS. (first published by Horsfield. *loc. cit. supra*). Dr. Buchanan Hamilton described a rat said to live in the cocoanut trees and bamboos of Bengal. The upper parts are said to be "dark iron-grey, consisting of black and tawny hairs, of which the former are the longest and most numerous. The lower parts and legs are white; the naked parts of the nose and toes are pale flesh colour." The head and body lengths of a full-grown male and female are given as 7″ and 8½″, their tails as 7½″ and 9″ respectively. If we suppose these measurements to have been taken on stretched skins, then this description, so far as it goes, will apply to many of the specimens obtained by the Mammal Survey in Bihar and Orissa. The Survey material indicates that the race inhabiting this part of Bengal is deserving of subspecific recognition, and I therefore propose to revive the name *arboreus* and to use it for the subspecies in question. Mr. Thomas (*P. Z. S.*, 1881, p. 532) has pointed out long ago that *arboreus* is based upon the description (and a drawing) cited above and not upon the specimen mentioned by Horsfield which is a Brown Rat (*R. norvegicus*). Mr. Wroughton (*J. Bombay Nat. Hist. Soc.*, Vol. XXI, p. 1190) has already stated that should a name be required for the "white bellied variety of *rufescens*" then "*arboreus*, Buchaman Hamilton, is available and most apposite."

Distribution:—Probably throughout the greater part of Bengal to the south and west of the Ganges.

Material examined:—In addition to some old material in the British Museum I have had at my disposal the following 72 specimens collected for the Mammal Survey by Mr. C. A. Crump:—17 (4 ♂ 13 ♀) from Daltonganj; 1 (♂) from Palamau; 3 (♂) from Barkagaon; 1 (♀) from Jagodih; 4 (2 ♂, 2 ♀) from Lohra; 19 (7 ♂, 12 ♀) from Gajhundi; 5 (3 ♂, 2 ♀) from Singar; 2 (♂ and ♀) from Nimiaghat; 15 (8 ♂, 7 ♀) from Pareshnath Hill; 1 (♀) from Sangajata, Chaibassa; and 4 (2 ♂, 2 ♀) from Luia, Chaibassa. Specimens from this collection are registered in the British Museum under the serial number 15· 4· 3.—

Description:—This is a relatively long-tailed race, with usually a short, thin, rather harsh, though not spiny coat. The general colour of the back is near "cinnamon brown" or tawny, greyer in young or quite unbleached specimens, yellower when older, much worn or bleached. The underparts are pure white or cream-coloured, the ventral hairs being light to their bases. The hairs around the genitalia are, however, often ochraceous. The feet are light, sometimes quite white, sometimes tawny above. The tail is a uniform light brown.

The mammæ were counted in 37 females; in 36 the formula was 2-3=10, 1 had 11 mammæ.

In the 72 specimens in adult pelage from Bihar and Orissa, enumerated above the head and body length varies between 134 and 174 mm. The Collector's measurements give the following averages and percentages:—

Average of 72 adults from Bihar
and Orissa:— ... ...159—215—31·6—23·2
Average of Head & Body length : 100—135—19·9—14·6

The specimens from all localities mentioned conform closely to these averages. The following table shows the variation of proportions with growth and may be compared with those given above:—

Head & Body. mm.	No. of specimens.	Average °/₀ of Head & Body formed by H. & B., Tail, Hind-foot, Ear.
112	1	100—154—25·9—17·9
134 to 138	3	100—135—22 —15·4
142 to 149	10	100—141—21·2—15·6
150 to 159	30	100—137·5-20·3—14·9
160 to 169	27	100—136—19·6—14·5
170 to 174	3	100—127—19·2—14·5

The skull is slightly smaller than in European races of *rattus*; (average condylo-basal length 39·5, instead of 40·5); the cranial and zygomatic widths are, therefore, relatively a little greater. Its chief peculiarities appear to be the outcome of more powerful temporal muscles and slightly larger cheek-teeth. Thus the least posterior inter-temporal distance (dimension 7) is less, both in relation to the condylo-basal length and to the cranial width; the temporal lines are in contact with the ends of the interparietal in adults, so that the parietals have no inter-temporal connection with the supraoccipital; the temporal wing of each parietal is large, its length being fully equal to half the length of the squamosal. The palatal length, diastema, palatal foramina, masseteric plates and tooth-rows are all longer relatively; the pterygoid region appears to be shortened, for while the distance condyle to bulla remains as in European races that between condyle and m. 3 is a little shorter. In several of these respects the skull of *R. r. arboreus* approaches that of *R. r. sikkimensis*; the bullæ are, however, obviously larger than in that species or its associate *R. r. tistæ*; in the present form moreover the orifices of the *canalis transversus* of the basisphenoid are distinctly visible, instead of being concealed in a direct ventral view.

Local variation:—

DALTONGANJ, Palamau (600′).

The dimensions of the most important are :—

·98 4661 ♂, 20 March 1914, 164—230—34—25
·99 4715 ♀, 24 ,, ,, 166—256—32—24, Weight 5¼ ozs.
4759 ♀, 29 ,, ,, 168—243—34—25 ,, 4¾ ozs.
Average of 17 (H. & B.) 134-168—155—221—31·3-23·4
,, % ,, ,, 100—142—20·2-15·1

All have rather short, thin and harsh coats, pure white bellies, yellowish-white feet and cold tinted tails and backs. No. 98 in full pelage has the back tawny and lined with black hairs; 4733, a ♀ from the same locality and 4643, a ♂ from Palamau itself (16th March; 158—212—32—25; weight 4¼ ozs.) are quite similar. The other specimens are darker, blacker or greyer above; probably the pelage is fresher in them than in the three tawny individuals and the full dorsal coloration is not yet developed.

GAJHUNDI, Hazaribagh (1,000′).

The following are the dimensions of the most important specimens :—

·94 4877 ♂, 10 May 1914, 168—208—30—24, Weight 4½ ozs.
·95 4886 ♂, 11 ,, ,, 168—211—34 5½ ,,
·96 4888 ♀, 11 ,, ,, 166—233—32—24 5½ ,,
·97 4898 ♀, 13 ,, ,, 164—208—31—24 5¼ ,,
Average of 19 (H. & B. 148-168) 159-211-31·1-22·8
,, % ,, ,, 100—133—19·6-14·3

Backs varying from tawny to dark greyish-brown and in this series the females appear to be generally darker than the males; dorsal tints always cold; bellies with hairs white throughout, often with a faint yellow tinge; feet white. No. 94 has a bright ochraceous patch on the right side of the throat and a much smaller spot on the left side.

PARESHNATH HILL, Hazaribagh (4,300′).

The dimensions of the most important are :—

·88 5130 ♂, 13 June 1914 166—235—33—24, Weight 5½ ozs.
·89 5132 ♂, 14 ,, ,, 173—215—32—25 6¾ ,,

·90 5107 ♂, 10 June 1914 169—228—31—25 5½ ozs.
Average of 15 (H. & B. 138-173) 156-211-31·4-22·8
,, % ,, ,, 100—135—20·1-14·6

These agree very closely with those from the other localities; the bellies in all are pure white, the feet light. No. 88 has a small yellow patch on the right side of the chest.

SINGAR, Gaya (1,400′).

The dimensions of the three registered specimens are:—
·91 4955 ♂, 23 May 1914, 174—240—34—25, Weight 6½ ozs.
·92 4931 ♀, 20 ,, ,, 158—217—33—25 5¼ ,,
·93 4939 ♀, 21 ,, ,, 170—203—33—25 5¾ ,,
Average of 5 (H. & B. 151-174) 161-215-33—23·8
,, ,, ,, 100—134—20·5-14·8

These and all the other specimens obtained by the Survey in Bihar and Orissa are really very much alike and call for no special comment. An old specimen (B. M. 66·12·28·6) collected by Mr. R. C. Beavan at Manbhum. Bengal, in January 1865, has longer and softer fur; its belly is of a pure but creamy white colour; its back is of a considerably brighter and warmer tint than are those of the specimens described above.

Remarks:—*R. r. arboreus* is a subspecies quite sharply differentiated from its allies, living on the other side of the Ganges, in Sikkim, Northern Bengal and Bhutan Douars, by its colder and more pallid coloration, its pure white belly (the phase or 'mutation' showing slaty bases to the ventral hairs being, apparently, quite absent), its shorter and especially thinner pelage, and its relatively long tail. The skull, in the hands of a patient observer, is also quite distinctive.

4. *Rattus rattus narbadæ*, subsp. n.

1913. *Epimys rufescens*, var. with white underparts. Wroughton, Report No. 7, Central Provinces, *J. Bombay Nat. Hist. Soc.*, Vol. XXII, p. 54.

Type:—A female (B. M. 12·11·29·132; Original No. 774) collected at Sakot, Hoshangabad, on 11th January 1912, by Mr. C. A. Crump; presented to the British Museum by the Bombay Natural History Society.

Distribution:—Central Provinces.

Material examined:—Hoshangabad District—1 (♀) from Sakot (1,200′); 8 (6 ♂, 2 ♀) from Dhain (1,400′); 3 (2 ♂, 1 ♀) from Bori (1,600′); 5 (3 ♂, 2 ♀) from Rarighat (2,500′); 2 (♂ and ♀) from Sonawanee, Balaghat (2,500′). Chanda District.—3 (1 ♂, 2 ♀) from Chanda (500′); 5 (3 ♂, 3 ♀) from Chickpalli (1,300′), Total 27 (16 ♂, 11 ♀). All these specimens were collected for the Mammal Survey by Mr. C. A. Crump; those since presented to the British Museum are registered under the serial number 12·11·29.—

Description:—In external appearance, size and proportions the present race is very similar to *R. r. arboreus*. The general dorsal colour is still colder, or greyer, on the average, than in the latter subspecies; and the long black hairs of the back show a more evident tendency, in *narbadæ*, to form a mid-dorsal stripe of black. The belly is white or pale yellow, sharply contrasted with the flanks; usually the ventral hairs are light throughout, but in some specimens they have slaty bases—a feature not seen in any of those from Bihar and Orissa. The feet are light above and show in some individuals a yellowish tinge or obscure dusky markings. The mammary formula of females is normally 2-3=10; but in the type and two or three others it is 3-3=12; *narbadæ* is apparently more variable in this respect than is *arboreus*.

The average dimensions of 26 adults (head and body ranging between 132 and 173) are:—

154—209—31·6—23 = 100—136—20·5—14·9

The following table shows the variation in the proportions which accompanies the increasing length of the head and body:—

Head and body. mm.	Number of specimens.	Average °/₀ of Head & body formed by H. & B. Tail, Hind-foot, Ear.
112	1	100—159 —26·8—19·7
130-139	2	100—138·5—23·3—17·7
140 to 149	6	100—139 —21·5—15·1
150 to 159	11	100—135 —20·25--14·9
160 to 169	6	100—134·5—20 —14·4
173	1	100—134 —19·7—14·5

The skull is slightly smaller than in *arboreus* (condylo-basa length averaging 38·4 instead of 39·5). The temporal muscles appear to be weaker (about as in *R. r. frugivorus*); for while the cranial width is relatively as great as in *arboreus*, the intertemporal distances (dimensions 6 and 7) are relatively greater and the zygomatic breadth is relatively less (see Table II); the parietals usually articulate by tongues with the supraoccipital above the temporal lines. The palatal length is shorter relatively—a difference apparently due to a shortening of the rostral portion of the palate.

From the skull of *R. r. frugivorus* it differs principally by its smaller size and shorter post-molar length – the latter character being due chiefly to a shortening of the pterygoid fossæ.

Local variation.—The following are the dimensions and notes on the coloration of the more important specimens from each of the different localities:—

SAKOT (1,200′).

·132 774 ♀, 11 Jan. 1912, 164—221—31—26, Weight 4¾ ozs., (Type) Ventral hairs white throughout but with a trace of a yellow tinge; as regards the upper parts only the flanks and feet are lighter in colour than are the dark-bellied rats from this locality. The present specimen has 12 mammæ.

DHAIN (1,400′).

.128 879 ♂, 5 Feb. 1912 153—211—31—22, Weight 4½ ozs.
.129 880 ♂, 5 ,, ,, 161—220—32—23 ,, 4¼ ,,
.130 901 ♂, 11 ,, ,, 153—200—33—22 ,, 4 ,,
·133 873 ♀, 3 ,, ,, 147—197—32—21 ,, 3½ ,,

Of these specimens No. 128 has less black on the back and lighter feet than has No. 127, a dark-bellied rat from the same locality; the ventral hairs have deep slaty bases and a strong superficial wash of pale yellow. Nos. 129 and 130 are similar dorsally; but the ventral hairs (except for a few with grey bases on the chest of 129) are white throughout and their feet are white. No. 133 is like No. 130 but greyer on the back. Among the unregistered specimens Nos. 860 and 871 have white bellies and the ventral hairs light throughout; No. 881 has some hairs on chest with slaty bases and a well marked yellow wash. In some of the specimens the contrast between the dirty white or yellowish tinge of the belly and the grey flank colour is not very sharp.

BORI (1,600′).

914 ♂, 17 Feb. 1912, 134—180—30—22, Weight 2¼ ozs.
9 ♂, 27 ,, ,, 132—188—32—25 ,, 2⅜ ,,
9 ♀, 21 ,, ,, 173—232—34—25 ,, 5½ ,,

The two young males have thick soft fur; in No. 914 the belly is *Apodemus*-like, the ventral hairs having deep slaty bases and white tips with a well marked pectoral stripe and collar of buff; in No. 938, noted as having the testes fully developed, the ventral hairs are pure lemon colour to their bases. In the old female the fur is thick, but short and much harsher than in the young; the back is yellowish-brown, brighter than in the young, and with much black along the middle line; the belly is a pure deep lemon to hair-bases; the feet have a dusky stripe above: and the mammary formula is 2-3=10.

RARIGHAT (2,500′).

·131, 957 ♂, 4 March 1912, 163—210—33—23, Weight 4¾ ozs.
·134, 959 ♀, 4 ,, ,, 158—225—34—27 ,, 4¾ ,,

Specimens from this locality have longer, softer and thicker fur than have those from Dhain. The bellies are white with an occasional superficial tinge of yellow along the middle line; ventral hairs light to their bases; tails slightly paler below than above. No. 134 has 10 mammæ.

SONAWANEE, BALAGHAT (2,500′).

·139, 1348 ♂, 28 May 1912, 152—208—31—21, Weight 3¾ ozs.
·140, 1350 ♀, 28 ,, ,, 158—217—31—24 ,, 3¼ ,,

These dorsally are very similar to No. 115, a dark-bellied rat from the same locality, both have white bellies, but in the male many of the hairs have slaty bases while in the female all are white to their bases. The female has 10 mammæ.

CHANDA (500′).

·137, 1471 ♀, 19 June 1912, 161—212—33—23, Weight 5½ ozs.
·138, 1552 ♀, 27 ,, ,, 155—220—31—23 ,, 5 ,,

Both these specimens show 10 mammæ and No. 137 contained 4 embryos. These are dull-coloured grey rats, with pure white or pale yellow bellies (ventral hairs unicoloured) and light feet. A male in full pelage (H. & B. 155) has short thin and rather spiny fur, the back being yellowish-brown lined with black; this is much like many of the specimens of *arboreus*.

CHICKPALLI, CHANDA (1,300′).

·135, 1403 ♂, 8 June 1912, 159—200—32—23, Weight 4½ ozs.
·118, 1415 ♂, 10 ,, ,, 146—220—33—22 ,, 3¾ ,,
·136, 1393 ♀, 6 ,, ,, 158—212—31—22 ,, 4 ,,

The bellies are white or pale yellow; in No. 118 many of the ventral hairs have dilute slaty bases but in the others they are light throughout. Both females from this locality have 10 mammæ.

Before offering some remarks upon the status of *R. r. narbadæ* it is necessary to describe briefly the dark-bellied rats associated with it in the Central Provinces. The following is the list of the material, collected by Mr. C. A. Crump, before me:—9 (4 ♂, 5 ♀) from Sakot; 1 (♀) from Dhain; 2 (♂) from Bori; 2 (♂) from Sohagpur, (1,000′); 1 (♂) from Rarighat; 9 (5 ♂, 4 ♀) from Sonawanee, Balaghat; 4 (1 ♂, 3 ♀) from Chanda; and 5 (4 ♂, 1 ♀) from Chickpalli. Total 33 (19 ♂, 14 ♀).

The following are the dimensions of the principal specimens :—

SAKOT.

·120	♂,	24	Jan.	1912,	133—175—30—22,	Weight	3	ozs.
·121	♂,	29	,,	,,	139—181—31—21	,,	3	,,
·125	♀,	22	,,	,,	139—180—30—22	..	3¼	,,
·126	♀,	24	,,	,,	175—214—31—25	,,	5¼	..

DHAIN.

·127	♀,	4	Feb.	1912,	147—203—31—21,	Weight	3¾	ozs.

BORI.

·122	♂,	20	Feb.	1912,	163—224—35—24,	Weight	4¼	ozs.
·123	♂,	20	,,	,,	166—233—35—25	,,	4¾	,,

SOHAGPUR.

·124	♂,	1	April	1912,	179—223—33—24,	Weight	5½	ozs.

BALAGHAT.

·113	♂,	27	May	1912,	159—190—33—24,	Weight	4¾	ozs.
·114	♂,	29	,,	,,	155—213—32—23	,,	4	,,
·115	♀,	27	..	,,	158—215—32—22	,,	4	..
·116	♀,	29	,,	,,	146—215—30—	,,	4	,,

CHANDA.

·119	♀,	21	June	1912,	150—210—32,	Weight	4¼	ozs.

CHICKPALLI.

·117	♂,	8	June	1912,	158—225—32—24,	Weight	5	ozs.
·118	♂,	8	,,	,,	146—220—33—22	,,	3¾	,,

The averages of 33 (H. & B. 130 to 179) from all localities are :—

148—202—31—22·6=100—136·5—21—15·3.

The averages of 15 (H. & B. 130 to 179) from Hoshangabad and Rarighat :—

147—191—31·2—23·1=100—130—21·2—15·7.

The averages of 5 (H. & B. 136 to 158) from Chickpalli are :—

145—221—31·2—22·2=100—152—21·6—15·3.

The variation of proportions with increasing body length is shown below. The relative tail length exhibits much irregularity when the 33 specimens are treated as a whole; but this irregularity is, to some extent, diminished by keeping the rats from Hoshangabad apart from those from Chanda. Although short-tailed rats appear to be more frequent in the former district and long-tailed rats more frequent in the latter, both types occur together in each locality:—

Head & Body in mm.	No. of specimens.	% of H. & B. formed by tail.	Hoshangabad.		Chanda.	
130 to 139	11	134·5	8	100-129-22·2-16·6	3	100-149-22·1-15·7
140 to 149	9	142·5	2	100-130-20 -15 2	7	100-146-21·2-15·2
150 to 159	8	135	1	100- -20·3-15·7	7	100-135-20·4-14·7
160 to 169	3	140	2	100-139-21·3-14·9	1	100-141-19·1-14·2
170 to 179	2	123	2	100-123-18·1-13·8		

On comparing this table with that given at p. 75 it will be seen that the white bellied *R. r. narbadæ*, as regards tail length, approximately represents the mean between the long-tailed and short-tailed, dark-bellied types just discussed.

In the quality of the pelage and in the dorsal colour these dark-bellied rats are very similar to the typical white bellied *R. r. narbadæ*; possibly the general tone of the backs is a little darker and greyer. The grey flank colour merges insensibly into the dusky tint of the belly. The ventral hairs are slaty throughout the greater part of their length, but their extreme tips are frequently yellowish and impart a very characteristic rusty tinge or bloom to the undersurface; this rustiness and the roughness of the ventral surface is very different in appearance from the bluish, sleek belly of *R. r. rattus*. Pale yellow or dirty white chest spots are not infrequently present. The feet are usually dusky brown above.

As will be seen from Tables I and II the skull agrees very closely in size and proportions with that of typical *narbadæ*; and I am quite unable to distinguish them.

Remarks:—I have had a good deal of difficulty in making up my mind as to the status of the rats of the Central Provinces, but after considering the facts in connection with what is found elsewhere, *e.g.*, in Kathiawar, it seems difficult to avoid the conclusion that in this district the dark bellied form is merely a parasitic development from the local white bellied race. With the acquisition of parasitic habits the stock seems to have become richer in pigment, and the tail length has alternatively been either greatly increased or greatly diminished. No change in the head muscles or skull has as yet been brought about. But the wild and the parasitic stocks are still mingled together in each locality; and doubtless each reacts on the other. In this probably lies the explanation of the fact that the degree of individual variation observable in *narbadæ* is far higher than that which we observed in *arboreus*.

As regards the relation of *narbadæ* with *arboreus*, a comparison of the typical white bellied series with those from Bihar and Orissa shows clearly that, while in both races old animals have a bright yellow-brown dorsal coloration and younger rats a greyer or less yellow one, the race from the Central Provinces is, on the average, one with colder dorsal tints. These colder tints are coupled with a greater tendency of the long black hairs to arrange themselves in a mid-dorsal stripe. These differences seem to have a geographical value. The smaller size and less modified condition of the skull in *narbadæ*, correlated as they appear to be with weaker temporal muscles, are still more striking characters—although, in part, they may be retrogressions. There seems thus to be ample justification for establishing *R. r. narbadæ* as a subspecies distinct from *arboreus*.

5. *Rattus rattus girensis*, subsp. n.

1913. *Epimys rufescens*, var. with white underparts. Ryley, Report No. 10. Kathiawar, *J. Bom. Nat. Hist. Soc.*, XXI, p. 481, 1913, *Epimys rufescens*. Ryley, *loc. cit.* (in part).

Type :—A female (B. M. No. 13·8·8·125 ; Original No. 1866), collected at Sasan, Junagadh, on 6th November 1912, by Mr. C. A. Crump for the Mammal Survey ; presented to the National Collection by the Bombay Natural History Society.

Distribution :—Southern Kathiawar ; abundant at the edge of the Gir Forest near Sasan, where it leads a natural outdoor life.

Material Examined :—26 (14 ♂, 12 ♀) from Sasan (400′) ; 1 (♂) from Keshod (300′) ; and 2 (♂ and ♀) from Talala (200′). Total 29 (16 ♂, 13 ♀) ; all collected for the Mammal Survey by Mr. C. A. Crump. Those since presented to the British Museum are registered under the serial number 13·8·8.—

Description :—In this form the fur is rather short and harsh, but usually not spiny. The general colour of the back is a cold drab, much like that of the duller coloured specimens of *narbadæ*, darkened along the mid-dorsal line by a greater or less number of long black hairs : individuals, however, present the usual range of variation in dorsal colour from mixtures of yellowish-brown and black to others in which the yellowish-brown is more or less completely replaced by grey. The belly is of a pure but dull white and it is sharply contrasted along a perfectly regular line with the dark grey flanks ; the ventral hairs are usually white from the tips to the basis. The feet are usually light above, their colour varying between a dirty white and a light yellowish-brown, with occasionally faint dusky markings.

The following are the dimensions of the more important specimens:—

SASAN (400′).

·122. 1862 ♂, 31 Oct. 1912, 159—209—32—21, Weight 4½ ozs.
·123. 1863 ♂, 1 Nov. ,, 154—177—32—23— ,, 5 ,,
1934 ♂, 8 ,, ,, 163—188—31—22— ,, 5 ,,
·124. 1865 ♀, 6 ,, ,, 142—191—30—21— ,, 3¾ ,,
·125. 1866 ♀, 6 ,, ,, 160—215—30—23— ,, 5¼ type

The average of 29 in adult pelage (Head and body 119 to 165):—
145—194—31·1—20·9=100—134—21·4—14·4

The change in the proportions with growth is as follows:—

Head and body, mm.	No. of specimens.	Average of head & body formed by H. & B. Tail, Hind-foot, Ear.
119 to 120	2	100—140—23·8—15·5
130 to 139	5	100—140—22·7—14·75
140 to 149	12	100—136—22· —14·5
150 to 159	6	100—129—20·3—14·3
160 to 165	4	100—129—19·4—13·7

The tail is thus distinctly shorter in adults than it is in *narbadæ* or *arboreus* (*cf.*, tables at pp. 78 and 75).

The mammæ could be counted in 8 of the females; in 6 (including the type) the formula is 2-3-10; 2 have 11 mammæ each, an extra one being present on one side in the pectoral region.

The skull is small (condylo-basal length averaging 37·1 instead of 38·4 as in *narbadæ*), about 3 mm. shorter than in *alexandrinus* and the cranial width is relatively a little greater than in the latter. Judging from the intertemporal distances (dimensions 6 and 7, Table II) the temporal muscles are scarcely weaker relatively than in *arboreus*; but the parietals articulate, above the temporal lines, rather broadly with the supraoccipital and the zygomatic breadth is scarcely greater relatively than in *narbadæ*. As in the latter form the palate and diastema are relatively slightly shorter than in *arboreus*, but the palatal foramina are a little longer. In several respects the cranial proportions are intermediate between those of *arboreus* and the European races of *rattus*.

Local Variation:—Little need be said on this score. The two from Talala (H. & B. 120 and 142) are very dark animals with dirty white bellies and dusky feet; these were taken in a hut. Four others from Sasan were also caught in a hut and these similarly possess such a dingy appearance that Miss Ryley listed them as "*Epimys rufescens*"; they, however, clearly belong to the white bellied race. The other specimens were trapped out of doors. In one only few of the chest hairs have slaty bases; in a few there is a slight trace of a ventral suffusion of yellow.

R. r. girensis appears to be confined to that part of Kathiawar which lies to the south of the Gir Hills. Although apparently not often found actually together, it is accompanied in this district by a dark bellied form. The latter is represented by 17 specimens among the material before me. Of these 17, only 1 (♀) was taken at Sasan; and this was caught in the hut mentioned above in the company of white bellied specimens; 7 (3 ♂, 4 ♀) are from Keshod, where 4 of them were caught in a fig tree and whence only 1 white bellied rat was obtained. The remaining 9 (3 ♂, 6 ♀) are from Junagadh (350′ to 480′); of these only 1 was taken out of doors and no white bellied rats were found at this locality. All with the exception of the 5 mentioned appear to have been trapped by Mr. Crump in huts of other dwellings.

Dark bellied specimens were obtained also from three localities in northern Kathiawar. Of these the following 20 are before me:—16 (8 ♂, 8 ♀) from Rajkot (100′); (♀) from Saturpur (20′); and 3 (1 ♂, 2 ♀) from Vankaneer (500′). None of these is marked by Mr. Crump as having been captured out of doors.

As regards colour these northern and southern specimens are similar; dorsally they are much like true *girensis* as above described, although the general tint of the back perhaps averages slightly darker. The flanks pass insensibly into the dark, rusty tinged belly. Several show white pectoral spots. The feet are usually dark brown above, but they are light coloured in a few of the specimens. The mammæ were counted in 12 females; 9 have 10 as usual; 1 has 11 and 2 have 12; the additions in each case are pectoral.

The following are the dimensions of the more important specimens:—

JUNAGADH (350′).

·121	♂,	26	Sept.	1912,	157—206—32—23	Weight	4	ozs.

KESHOD (300′).

·116	♂,	7	Oct.	1912,	166— —33—23	,,	4½	,,
·117	♀,	7	,,	,,	160—211—33—24	,,	5½	,,
·118	♀,	7	,,	,,	150—224—33—23	,,	4	,,

RAJKOT (100′).

·119	♂,	21	Dec.	1912,	150—195—30—21	,,	5¼	,,
·120	♀,	25	,,	,,	150—192—30—21	,,	3¾	,,

The changes in proportions transpiring with growth may be tabulated as follows :—

Southern Kathiawar.			Northern Kathiawar.	
122			1	100-116-22·1-15·6
130 to 139	2	100-139-22·5-14·4	3	100-135-22·1-15·1
140 to 149	2	100-144-21·5-14·1	8	100-130·5-21·6-15·25
150 to 159	9	100-136-20·7-14·5	7	100-125·5-19·9-13·9
160 to 166	4	100-123-19·4-13·6	1	100- 19·4-15·6

This table brings out two interesting facts. If firstly the figures given for the southern specimens be compared with those of the table at p. 82 it will be seen that the three largest stages are represented by rats with tails either much longer or much shorter relatively than those of equally grown individuals of the wild *girensis* from the same district. That is to say, we meet with an exactly similar departure from type in the dark bellied form of this district as we do in the Central Provinces. Secondly the northern dark bellied rats are distinguished from both *girensis* and the southern dark bellied specimens in every stage of growth by their shorter tails.

The skull is similar in both northern and southern dark bellied rats and as regards size it agrees with that of *girensis*. But it presents characters which suggest that the dark bellied rat is the indoor animal, living on a softer diet and therefore developing a weaker set of jaw muscles than those of the outdoor, harder living, white bellied *girensis*. Thus the intertemporal distances are increased (see Table II), both in relation to the condylo-basal length and to the cranial width ; this increase indicates a diminished area of origin for the temporal muscles. The masseteric plate is correspondingly a little narrower. The anterior palatal foramina are as large as in *girensis* ; while the palatal length is less and the post-molar length greater—each of these two last dimensions being relatively nearly as in European races.

Remarks :—*R. r. girensis* is widely separated geographically from all the other white bellied races of India. Although in colour it closely resembles *narbadæ* it is quite satisfactorily distinguished from the latter by its cranial peculiarities and shorter tail, and it undoubtedly deserves subspecific recognition.

The dark bellied rats of Kathiawar are, in my opinion, plainly indoor developments from *girensis*. The southern stock is already quite clearly differentiated by its cranial characters and colour from its neighbour and parent; the northern race more completely cut off from the wild parent, has moreover shortened its tail. This sharp differentiation between the wild parent and its parasitic offspring is in striking contrast with the relations between the corresponding forms of the Central Provinces; but this contrast finds a ready explanation when one considers the restricted distribution of the parent and the well marked differences of station in Kathiawar on the one hand, and the universal distribution and complete confusion of stocks in the Central Provinces on the other.

6. *Rattus rattus satarœ*, subsp. n.

1913. *Epimys rufescens*, variety with white underparts. Wroughton, Report No. 22, Koyna Valley. *J. Bombay Nat. Hist. Soc.*, Vol. XXIV, p. 315.

Type:—A female (B. M. No. 15·7·3·56; Original No. 138) collected at Ghatmatha, Satara District, on 18th December 1914, by Mr. S. H. Prater for the Mammal Survey; presented to the British Museum by the Bombay Natural History Society.

Distribution:—Known at present only from the edge of the Western Ghats at the type locality altitude about 2,000′.

Material examined:—7 (1 ♂, 6 ♀) all collected for the Mammal Survey by Mr. S. H. Prater at the type locality; the specimens presented to the British Museum are registered under the serial number 15-7-3.

Description:—This is a soft and fully furred subspecies, its coat being distinctly longer and thicker than in *arboreus*. *narbadœ* and *girensis*. In fresh pelage the general colour of the back is a bright "clay" or golden brown, much darkened by long black hairs (Nos. 137, 138 and 141); in what is possibly a less developed phase, of the coloration the golden tint is duller and the black less intense (No. 140), and in an old specimen (No. 139) very few black hairs are present and the back is bleached to an almost uniform light golden brown. The underparts are clothed throughout with thick, long and soft creamy white fur, the hairs being everywhere light to their bases. The feet are yellowish brown. The tails, unicoloured and dusky, are remarkable for their very great length. The following are the dimensions:—

·55, 137 ♂, 18 Dec. 1914, 141-243-32-24=100-172-22·7-17
136 ♀, 18 ,, ,, 149-230-33-25=100-154-22·2-16·8
·56, 138 ♀, 18 ,, ,, 146-233-32-25=100-160-21·9-17-1
·57, 139 ♀, 19 ,, ,, 165-245-32-27=100-148-19·4-16·4
·58, 140 ♀, 19 ,, ,, 151-230-31-25=100-152-20·5-16·5
141 ♀, 19 ,, ,, 156-250-35-23=100-160-22·5-14·7
Juv. 142 ♀, 19 ,, ,, 121-182-30-23=100-150-24·8·19
Average of 6 adults:—151-238-32·5·24-8=100-158-21·6·16·4

The young specimen is, of course, much duller than are the adults; it shows a moult patch on the head between the ears.

The mammæ were ascertained in 4 of the females to be 2-3=10.

The skull is about as large as in *arboreus* (condylo-basal length averaging 39·7), but the zygomatic breadth is relatively small, about as in *narbadæ*. The cranial and greatest intertemporal widths are very great, but the temporal lines curve inwards so much posteriorly that the least intertemporal width behind is, relatively to the condylo-basal length, not much greater than in *frugivorus* and in relation to the cranial width is 2 % less than in the latter. The temporal lines are quite faintly marked and the supraorbital beads are very weakly developed. The parietals articulate broadly with the supraoccipital above the temporal lines. The palatal length is 2½% longer than in European races; the diastema, anterior palatal foramina and tooth-rows all showing increased lengths. On the other hand both post-molar lengths (condyle to m. 3, condyle to bulla) are reduced, the pterygoid fossæ in particular being short. The masseteric plate is also rather narrow. From these features it would appear that all the jaw muscles are weak.

Remarks:—This is apparently a very sharply defined local race distinguished from all other Indian subspecies by its peculiar skull and relatively long tail. By its bright dorsal coloration it resembles the form occurring in the southern half of the peninsula and differs from the duller subspecies of Bengal and the Central Provinces. The dark bellied rats collected at Ghatmatha and in the Koyna Valley immediately below seem to have no connection with *sataræ* and to have been derived from some other stock.

(*To be continued.*)

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams

BY

F. Wall, C.M.G., C.M.Z.S., F.L.S., Lieut.-Colonel, I.M.S.

Part XXVI (with Plate XXVI and Diagram).

(Continued from page 635 of Volume XXV.)

As now classified the large family *Colubridæ* is divided into three "series" depending upon peculiarities in the dentition of the Maxillæ.

Series A. Aglypha (Greek "a" without, and "glupho" I carve) comprises those snakes that have no grooved (carved) nor canaliculate fangs.

Series B. Opisthoglypha (Greek "opisthe" behind, and "glupho") the representatives of which have grooved fang-like teeth at the back of the maxilla.

Series C. Proteroglypha (Greek "proteros" in front, and "glupho") including those snakes with a pair of canaliculate or true fangs in the front of the maxilla. The first subject of this paper comes into "Series" B, and the second into "Series" C.

"Series" B. *OPISTHOGLYPHA.*

This "Series" comprises three sub-families (1) Homalopsinæ, (2) Dipsadomorphiinæ, and (3) Elachistodontinæ. The first of these contains our first subject.

Sub-family *HOMALOPSINÆ.*

This is again divided so as to represent ten genera, seven of which occur within Indian limits.

Genus *CERBERUS.*

Three species are known, one Australian, one peculiar to the Philippines, and a third *rhynchops* which has a wide range of distribution in India and beyond.

CERBERUS RHYNCHOPS (Schneider).

The Dog-faced Water snake.

History.—This was first brought to the notice of the scientific world by Russell who figured it twice, once in his First Volume

(Plate XVII) which appeared in 1796, and again in the Second Volume (Plate XL) issued in 1801. It was first christened by Schneider in 1799. Its synonymy differed with almost every writer until 1864 when Gunther fixed the proper designation under which it now rests.

Nomenclature. (*a*) *Scientific.*—The generic title is from Greek "kerberos," the famous three-headed dog that guarded the entrance to Hades in Grecian mythology. The name appears to have been suggested by the forbidding aspect of the snake. The specific name is also from Greek ("rhunchos" snout, and "ops" face) probably in allusion to the peculiar under-hung condition of the lower jaw.

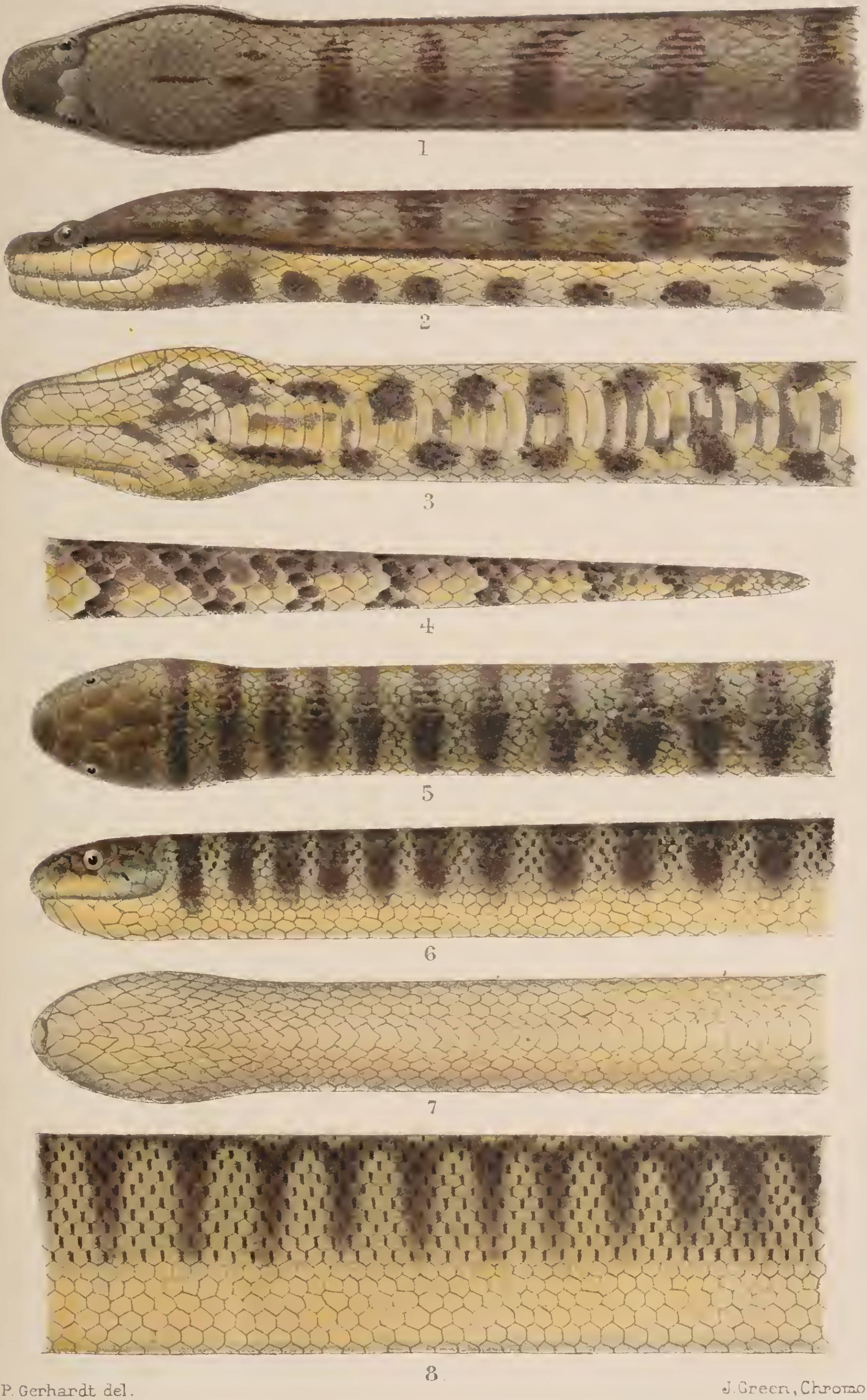
(*b*) *English.*—The dog-faced water snake seems to me appropriate, and is not only distinctive but accords with the scientific generic name.

(*c*) *Vernacular.*—None known to me.

General Characters.—The head is pear-shaped as seen from above expanding considerably towards the occiput. The snout is narrow, and in profile shows an unusually prominent lower jaw little if at all shorter than the upper. This feature to a large extent gives the snake its forbidding expression. The nostrils are directed almost as much upwards as laterally and are narrow slits convex forwards. They approach the condition seen in the sea-snakes. The eye is rather small, directed as much upwards as laterally, and the eyebrow is remarkably prominent. The iris is minutely speckled with gold and reveals a vertically elliptical pupil. The neck is fairly evident. The body is stout, and rough from the strong keels on the costal scales. It is dull dorsally, glossy on the belly, including the last three costal rows. The tail is short, rather compressed at the base, and rapidly tapers to an obtuse point. It is about one-fifth the total length of the snake.

Dimensions.—Most specimens range between two and three feet, and anything over this is unusual. The longest of which I am aware is that reported by Stoliczka from Burma which was four feet, two inches.

Colouration.—The back is bluish grey when the snake is submerged, lightish grey when dry. It is crossed by numerous ill-defined but conspicuous darker bars involving one to two scales in the length of the snake, the intervals involving five to seven scales. These bars grow less distinct posteriorly, and the foremost are broken up into spots in some specimens. The dorsal colouration ceases abruptly about midcosta, and is replaced by buff subcostally, and venerally. The belly is buff coarsely spotted or dappled with deep greenish black. The head is coloured above like the back, and the grey is sharply defined just above the supralabials. The upper lip and chin are buff. A conspicuous



P. Gerhardt del.

J. Green, Chromo.

THE COMMON INDIAN SNAKES, (Wall.)

1-4. Cerberus rhynchops, *harmless*. 5-8. Enhydrina curtus, *poisonous*.

all nat. size.

dark postocular streak is prolonged backwards to the side of the forebody.

Identification.—The frontal which is partially, and the parietals which are wholly broken up, furnish an easy means of knowing the snake, but perhaps a more certain method is as follows:—A snake which when laid on its back, reveals well developed ventrals at least three times the breadth of the last costal row, and at the same time shows three or more rows of costals on each side of the ventrals will prove to be a Homalopsid. *Cerberus* will be easily distinguished from its near Indian relations by possessing (1) two internasals, (2) 9 to 10 supralabials, and (3) 23 to 27 costal rows in midbody.

Haunts and habits.—It is eminently an aquatic species usually inhabiting the brackish waters of tidal-rivers, creeks, and estuaries. Ferguson and Cantor say that it frequents fresh water also, and Cantor, Haly and Flower, all report it from the sea in close proximity to our coasts. I became acquainted with it in Burma, and frequently observed it in the waters of the narrowest channels connected with the tidal-river system, as well as in the river itself. I frequently saw it swimming in the ebb and flood tides. It swims powerfully usually allowing itself to be carried with the stream, but it sometimes anchors itself to a convenient bamboo stake, anchor rope, or submerged branch by its tail, and from this purchase swings about in the current on the look-out for fish passing by. As the tide ran out many were observed lying along the branches of the trees, and bushes just above the water, and when hustled dropped off into the stream below. Numbers were left stranded on the mud flats left by the receding tide and in the teak yards nearly every bole harboured beneath it, some of these snakes. I have seen it exhibit some intelligence in the following manner. Lying extended in the length of a nearly empty ditch, after a period of quietude, it flicks its tail round first on one side and then the other in such a way as to make an unwary fish recede from the movement towards its head, when coming within sight the fish falls an easy victim to the manœuvre. Taken at a disadvantage on land it will occasionally exhibit great activity, and try to escape. When prevented from so doing it protrudes the tongue, and hisses, and flattens itself on the ground. When held down by a stick it will sometimes strike, and bite viciously, and under such excitement emits a disagreeable odour not necessarily accompanied by a discharge of the cloacal contents. When picked up it wreaths itself with some force around the hand.

Its mode of progression is curious. The body is thrown forward in a curve in advance of the head, and the head subsequently advanced, the body being again thrown forward before the snake quite extends itself. It gives the impression of moving sideways.

Disposition.—In spite of its forbidding appearance this is a peculiarly inoffensive reptile. Blanford and other have remarked upon its quiet nature and I can support their observations. It does not usually take alarm when encountered, but will permit one to approach close enough to place a stick over it, and allow itself to be captured. In captivity it is a singularly uninteresting, lethargic creature allowing itself to be handled, and rarely betraying a malicious spirit. Drumming on the glass of the vivarium even when its nose is against the glass, usually evokes little if any response. In a tank it is hardly more interesting.

Food.—It feeds exclusively and voraciously on fishes. About Rangoon on the mud flats it frequently pursued a little fish commonly called the walking perch from its mode of active progression on the mud by means of fins that are used as legs. I once found a large fish eight inches in length inside a specimen measuring three feet, three inches. I have also known an eel taken. I frequently saw *Cerberus* wriggling at the end of a fisherman's hook bated with a fish, to the disgust of the angler.

Breeding.—This like all the other Homalopsids I know is viviparous in habit. The young are born in May, June and July, but it is quite likely further observations may extend the season already known. The period of gestation is now known, but from analogy is likely to exceed six months. I found eggs with no trace of an embryo in a gravid female from Rangoon on the 21st February 1900.

It is fairly prolific, its brood amounting to at least 26. Gunther records a brood of 8. My specimen above alluded to contained 7 eggs, and three gravid females received from Moulmein captured between the 26th March and 4th April 1900, contained 14, 23 and 26 eggs. These were all in about the same stage of development, the embryos within measuring about 2½ inches.

Growth.—In spite of the meagre figures at my disposal these furnish a good deal of information. Gunther's brood already referred to measured from 7 to 7½ inches. I have had small specimens in Burma brought to me measuring 7⅝ and 7⅞ inches in May and July respectively. I find the young double their length in the first year of life, and have about trebled it by the end of the second year. It would probably take another two years before specimens attained to three feet, and I have examples of such 3 feet 1 inch, and 3 feet 3 inches in June from Burma. Unfortunately, I have lost my detailed notes regarding the length of my gravid females, so am unable to say when the species is sexually mature.

Distribution.—It occurs all along out Indian Coasts from Sind and Mekran in the North-west to Tenasserim, and through the Malayan Region to the Philippines and Pelew Islands.

It is quite common around India, but not nearly so common as in Burma where there must be literally thousands in every tidal-river. Haly reports it common in Ceylon, and Blyth says the same with reference to the Andamans. It occurs in the Nicobars.

Lepidosis, Rostral.—In contact with 4 shields, the rostro-nasal, and rostro-labial sutures subequal; sometimes a partial median suture is seen in the upper part of the shield. *Internasals.*—Two, sub-triangular; their bases apposed in the median line; the suture between them equal to rather greater than that between the præfrontal fellows, subequal to the internaso-præfrontal suture. *Præfrontals.*—Two, the suture between them subequal to the præfronto-frontal; in contact with nasal, loreal and præocular. *Frontal.*—In contact with 7 shields, frequently more or less disintegrated posteriorly. *Parietals* —Disintegrated into many parts. *Nasals.*—In contact behind the rostral; touching the first labial only. *Loreal.*—Present. *Præocular.*—One. *Postoculars.*—One or two. *Temporals.*—Replaced by small scales.

Suboculars.—One to three. *Supralabials.*—9 or 10, none touching the eye; the last three or four divided into an upper and lower part. *Infralabials.*—Many small.

Sublinguals.—One pair only present; in contact with 3 or 4 infralabials. *Costals.*—Two headslengths behind the head 25 (rarely 23); midbody 23 to 25 (rarely 27); two headslengths before the anus 19 or 17. Where the rows are 25 they reduce to 23 and again to 21 by a fusion of the 4th and 5th, or 5th and 6th rows; from 21 to 19 the 3rd and 4th rows fuse. Strongly keeled in all rows except the last for a variable extent posteriorly.

Ventrals.—Well-developed, 132 to 160. *Anal.*—Divided. *Subcaudals.*—Divided. 49 to 72.

Dentition.—*Maxillary.* 15 to 16 teeth are followed by a short edentulous space, after which there is a pair of grooved pseudo fangs little if at all larger than the preceding teeth. *Palatine.*—9. *Pterygoid.*—22 to 25. *Mandibular.*—20 to 23; the 3rd to about the 7th longest and subequal.

Our plate.—Mr. Green and Mr. Gerhardt have very faithfully portrayed a typical specimen.

"Series" C. *PROTEROGLYPHA.*

The "Series" is again divided into sub-families (1) *Hydrophiinæ* including the marine forms with valvular nostrils, strongly compressed bodies (except *Platurus*) and compressed fin-like tails, and (2) *Elapinæ* which includes the terrestrial poisonous snakes with open nostrils, round or feebly compressed bodies, and a cylindrical and tapering tail.

Sub-family *HYDROPHIINÆ.*

This contains at least eleven genera, one of which *Enhydris* includes the first sea-snake to be discussed in these papers.

Genus *ENHYDRIS.*

(Greek "En" in, and "hudor" water).

Stejneger has thrown doubts on the validity of this name for the genus for which he substitutes *Lapemis* (Herpetology of Japan, 1907, p. 435). I adhere to the generic title used by Boulonger as late as 1912 (Fauna of Malay Peninsula, Rept and Batrach., p. 192) which is the one with which all of us have grown familiar It contains only two species, viz., *curtus*, a very common snake, around our coasts, and *hardwicki* rare in Indian seas, but common further east in the Malayan Archipelago.

ENHYDRIS CURTUS (Shaw).

Shaw's Sea-snake.

History.—Described by Shaw in 1802 from a young specimen labelled "India" (the type) now in the British Museum.

Nomenclature. (*a*) *Scientific.*—The generic name simply implies "water snake," and the specific is from the Latin "curtus" meaning short.

(*b*) *English.*—I think it a fitting tribute to the work of Shaw, once the herpetologist, and custodian of the reptile collections in the British Museum, to associate his name with the species.

(*c*) *Vernacular.*—None known to me.

General Characters.—The species is remarkably stout, and short for a sea-snake. The head is massive, and the jaws strong, the body heavy, short, and strongly compressed, and the tail markedly compressed, and fin-like.

Colour.—The dorsum is olivaceous-green merging about midcosta to pale yellow. The back is beset with a series of dark greenish-brown or greenish-black rather ill-defined crossbars, about 45 to 55 in number, and rather broader than the interspaces. The first of these passes across the back of the head. In the young these bars extend further ventrally, and often form complete bands.

Identification.—Very easily recognised among all Indian sea-snakes on account of the disintegrate condition of the parietal shields. An alternative method concerns the breadth and number of the ventrals. These shields are so little enlarged in midbody and posteriorly that they hardly deserve the name of shields, but would be better considered as scales. Their number 130 to 219, with their feeble development will establish the genus. *Curtus* is easily distinguished from *hardwicki* by the parietal shields being broken up into three parts (rarely more). Again in *curtus* with very few exceptions the suture from the nostril passes to the second supralabial, whereas in *hardwicki* it passes to the first.

Habits.—It frequents our Indian Coasts in large numbers. In rough weather in common with other sea-snakes it appears to keep well out to sea, judging from the dearth of numbers brought in from the fishing nets at this time. I have known a specimen taken on land close to a backwater one and-a-half miles from the sea. Out of 84 specimens collected in June and July this year which I sexed 21 were ♂ and 28 ♀. The tubercles on the scales in females are feeble, but in males are stronger, and on the lowest costal rows in old adults actually spinose. The male when adult has also a distinct swelling at the base of the tail not seen in the female.

Breeding.—The season for the birth of the young is probably from May to August. I had 12 gravid females from Madras between the 20th June and the 12th of July this year. The fœtuses 22 in number ranged between 8½ and 14 inches. Other specimens already born this year numbering 9, measured from 13¾ to 17½ inches. From this one may infer that the 17½ inch specimen had been born probably in May if not before, and that the 8⅝, and 8½ inch specimens would not have been born till August, or possibly later. Seven of the nine young of the year measured from 13 to 15 inches, and this taken with the fact that one fœtus measured 14 inches, makes it appear that the young are about 13 to 14 inches long at birth. They are contained in the usual transparent sacs seen in viviparous snakes, but these are relatively much larger than I have observed in other species. Most of the sacs were 3 inches, some 4 and one even 4¼ inches in length.

It is the least prolific of all the snakes I know except *Hydrophis gracilis.*—Four mothers contained but a single fœtus, seven contained 2 only (one of these an infertile egg also), and one held 4 embryos. These mothers varied in length from 27 to 32½ inches and it appears to me that the smallest length would have been attained at the end of the second year of life. If my inference is justified from the figures at my command, this species attains to sexual maturity a year earlier than other snakes whose habits I have studied. I find that at the end of the first year seven specimens had attained to a length of from 19 to 21¾ inches, and if a similar rate of growth is allowed for the second year, *i.e.*, 6 to 8 inches, the length of the smallest mother would easily be acquired by that time.

Food.—Remains of fish in the stomachs of many show it depends upon this form of diet in common with other hydrophids. I was not able to procure any fish in a suitable state to make the identification probable.

Poison.—I know of no records in the human subject of a bite, but the venom has been experimented with in the laboratory by Fraser and Elliot.

Quality.—The poison from Madras specimens submitted to these experts was described as consisting of thin scales of a very pale yellow colour.

Quantity.—Dr. Pinto who collected the poison found the average yield from eight fresh specimens represented ·00275 grammes when dried.

Toxins.—Fraser and Elliot found the effects of the poison on lower animals almost exactly that produced by cobra venom, except that the respiratory embarrassment in *curtus* poisoning was much more pronounced. The action is practically identical with that of *Enhydrina* venom. As this is dealt with fully in the 28th and last paper of this series the reader is referred to that article for particulars of the composition and action, of this poison, symptoms and treatment. Death is caused by a paralysis of the respiratory centre in the brain as in the toxæmiæ of other colubrine snakes.

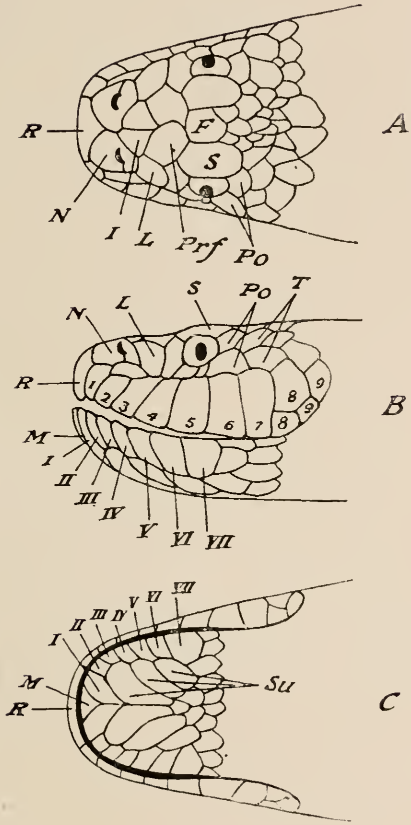
Lethal dose.—The minimal lethal dose for rats is ·0006 grammes per kilogramme weight of the rodent. As the lethal dose of *Enhydrina* venom for rats was found to be ·00009 grammes, the toxicity of this is about seven times greater than that of *curtus.*

Distribution.—From the Persian Gulf to the Malayan Archipelago. I found it very common on the Malabar Coast about Cannanore, where it is only second to *Enhydrina valakadyn* in its numerical strength. On the Coromandel Coast at Madras a collection of 192 sea-snakes furnished me with 84 specimens as compared with 60 *Enhydrinas.*

Lepidosis, ¾ *Rostral.*—Touches 4 shields, the portion visible above one-third or less than one-third the length of the suture between the nasals. *Nasals.*—Touch the 1st and 2nd supralabials; the suture from the nostril passes to the 2nd (rarely 1st) supralabial.

Præfontals.—Touch the 2nd supralabial. *Frontal.*—Entire.

Parietals.—Disintegrate, usually into three parts. *Præocular.*—One. *Postocular.*—One or two. *Temporals.*—Scale-like, two or three superposed scales anteriorly. *Supralabials.*—7 usually (sometimes 8); the 3rd and 4th normally touch the eye (rarely the 4th only or the 3rd, 4th and 5th). *Infralabials.*—4; the 4th largest, and in contact with three or four scales behind. *Marginals.*—A complete row after the 2nd infralabial. *Sublinguals.*—Poorly developed. Often so small as hardly to deserve the name; both fellows separated by scales. *Costals.*—Two headslengths behind the head 29 to 36; midbody 30 to 45; two headslengths before the anus 31 to 32; tuberculate, juxtaposed everywhere; the lowest 3 or 4 rows enlarged and in old males often with spinose tubercles. *Ventrals.*—151 to 219; entire anteriorly, divided posteriorly. Each part in old males with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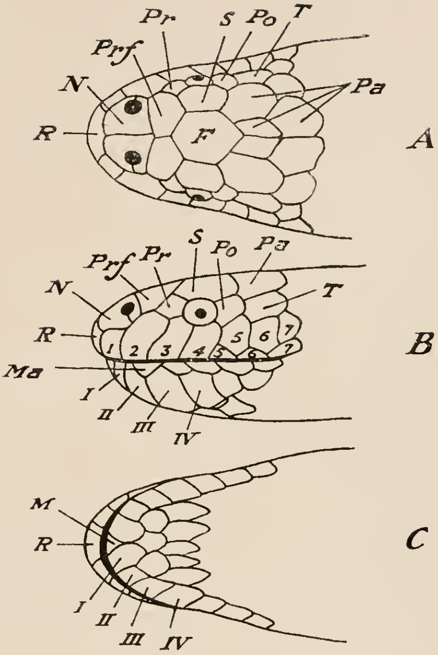
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ENHYDRIS CURTUS
(nat. size.)

COMMON INDIAN SNAKES.

spinose tubercles. *Dentition.* *Maxilla.*—Behind the paired fangs there are usually 4 (rarely 3) grooved teeth. Palatine 5 to 6; an edentulous space behind that would accommodate about two more teeth. *Pterygoid.*—18 to 22. *Mandibular*—12 to 16.

Our plate is in every way excellent.

(*Explanation of figures for all.*)

F.	Frontal.
I.	Internasals.
L.	Loreal.
M.	Mental.
Ma.	Marginal.
N.	Nasals.
Pa.	Parietals.
Po.	Postoculars.
Pr.	Præocular.
Prf.	Præfrontals.
R.	Rostral.
S.	Supraocular.
Su.	Sublingual.
T.	Temporals.
Arabic numerals	Supralabials.
Roman ,,	Infralabials.

(*To be continued.*)

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. Bell, I.F.S.

(Continued from page 664 of Vol. XXV.)

Part XXI.

12. Genus—Jamides.

Two very different butterflies have been included in this genus of late. Formerly it consisted of a single species, *bochus*. The genus *Lampides* contained 9 species, one of which used to be called *ælianus*; this was changed into *celeno* and transferred to the genus *Jamides*. So, at present, there is *Jamides bochus* and *Jamides celeno*. The former is a medium-sized insect with, in the male, the most brilliant, deep, metallic blue upperside; the latter somewhat larger, milky-white above; the one rather quick in its motions, the other rather weak and flimsy; *bochus* occurring throughout the whole of India, Ceylon, the Nicobars and Andamans; away to, and including Australia, Burma; *celeno* having much the same distribution except that it has not been met with in Australia or in the Nicobars. Neither species inhabits Sind and desert regions and the latter is found up to a height of 5,000′, while the former affects lower levels. They are both fairly plentiful, wherever they occur, in the way of specimens though, perhaps, *celeno* is the commoner of the two. The transformations of both are known and will be found fully described below; the larvæ and pupæ are not very dissimilar and both are intermittently attended by ants of different species. The habits of the two butterflies are somewhat different as has already been mentioned; both are occasionally to be seen sucking up moisture in damp places, neither is particularly fond of flowers. Finally, the larva of both species feed on the insides of pods of leguminous plants as a matter of preference; they will also eat leaves.

150. Jamides bochus—Male (Pl. G., fig. 41)—*Upperside*, fore wing: velvety jet-black; base deep blue, beautifully metallic and shining, measured on the dorsum this colour occupies three-fourths of its length from base, its outer margin then curves upwards just past the apex of the cell, enters into the bases of interspaces 10, 11 and 12 and fills the whole of the cell. Hind wing: costal margin above subcostal vein and vein 7, and dorsal margin narrowly fuscous black, a medial, longitudinal, pale streak on the former; terminal margin narrowly edged with velvety black, inside which in interspaces 1 and 2 is a slender, transverse, whitish line, with an elongate, irregular, transverse, black spot above it in interspace 1 and a more obscure, similar spot in interspace 2; traces of such spots also are present in some specimens in the anterior interspaces. *Cilia* of both fore and hind wings black; filamentous tail at apex of vein 2 black, tipped with white. *Underside*: dark chocolate-brown. Fore and hind wings: transversly crossed by the following very slender, white lines all more or less broken into short pieces. Fore wing: a short pair, one on each side of and parallel to the discocellulars, a pale streak sometimes along the diss cocellulars themselves; a single line in continuation of the outer of the discocellular lines, extends down to vein 1; an upper discal pair of line-that forms a more or less catenulated, short band extend from the costa to vein 3, the inner lines of the two continued to vein 1; two more obscure, subterminal, composed of inwardly-convex lunules and a single, straight, terminal line, the area enclosed between the subterminal lines and between the terminal line darker in the interspaces, giving the appearance of two obscure, subterminal lines of spots edged inwardly and outwardly by white lines. Hind wing: crossed in the middle by nine very broken and irregular lines, by fewer above and below: tracing them from the costa downwards their middle short pieces are found to be shifted outwards and a few are short and not complete, the inner two are posteriorly bent abruptly upwards, the subterminal two are lunular and the terminal line nearly continuous; posteriorly, between the subterminal pair of lines, in interspace 1, there is a small black spot inwardly edged with orange and in interspace 2 a much larger, round, black spot: both black spots are touched with metallic blue scales. Antennæ (the tip of stub and orange inside opalescent at base), head, thorax and abdomen black; beneath, the shaft of the antennæ banded with white: palpi, thorax and abdomen narrowly white Female. (Pl. G, fig. 41a)—Similar to the male generally but with the following differences:—*Upperside*, fore wing: ground-colour fuscous opaque black, not velvety black, blue basal area more restricted and not so deep a blue nor at all metallic. Hind wing: the black costal and terminal margins very much broader, the blue on the basal area consequently much restricted and of the same shade as the blue on the fore wing; terminal margin with a subterminal, anteriorly obsolescent series of spots of a shade darker than that of the terminal black area on which they are superposed; these spots posteriorly more or less distinctly encircled inwardly with slender lines of blue and outwardly of white; anteriorly these lines are almost obsolete *Cilia* of both fore and hind wings and the filamentous short tail, as in the male. *Underside*: similar to that of the male, but the ground-colour generally paler and duller; the transverse, white lines broader and more clearly defined. Antennæ, head, thorax and abdomen as in the male. No fringe of hairs to the inner margin of fore wing in either sex. Expanse: Male and female, 34-38 mm.

Larva.—Normal. Head hidden under segment 2, small, round, shining yellow; mandibles dark; segment 2 broadly semi-circular in outline rather flattened, the front margin with a small, shallow sinus in dorsal line, the dorsal depression 4-sided as usual and covered closely with minute. black tubercles; segment 3 slightly higher than 2 and a good deal broader, 4 again higher and a little broader than 3; segments 4-10 about equal to each other in breadth and height: 11-14 dorsally flattened, sloping gently to the rounded end. Surface of body dull; a slight, central, dorsal depression on segments 3, 4; a lateral, somewhat accentuated, lengthened depression parallel to and behind front margin and another, similar, central, spiracular one in which, at the upper end, the spiracle is situated: one of each to each segment 4-11; gland of segment 11 transverse, linear: organs of segment 12 circular-mouthed, protruding cylindrical, white tubes at will: some few simple, moderately long, erect, white hairs from margin of anal segment: the surface densely clothed all over with minute conical, fine erect, black hairs from tiny, star-shaped bases mixed with a few golden similar ones. Spiracles of ordinary shape and size. Colour: dirty, soiled rose, with a moderately broad, lateral, neutral-tint coloured line and a similar, dorsal, longitudinal line. L: 11 mm.; B: 5 mm.; H. 4 mm.

Pupa.—Normal. Head with the frons perpendicular to the longitudinal axis of pupa, high, the vertex just visible from above beyond the front margin of segment 2; this segment with the free, front margin rounded, of ordinary length, the dorsal line very gently sloped towards thorax:

thorax with its dorsal line steeper on the anterior portion than that of segment 2, humped in middle; a good deal broader than segment 2, rather pointed behind ; constriction behind it dorsally slight, laterally nothing ; pupa highest at apex of thorax though, perhaps, thicker at segment 7 owing to the ventral line not being quite straight ; abdomen circular in transverse section running to a blunt, rounded point at anal end which is slightly turned under. Surface shining, especially on thorax and wings, covered with minute hairs under the lens, these hairs slightly longer at fore and hinder extremities of the body. Spiracles of segment 2 longly oval, slightly raised, short, white ; the other spiracles broadly oval. small and inconspicuous, coloured like the body. Colour of pupa a rose-brown yellow on the abdomen, dirty translucent-looking yellow on wings, thorax and head ; spotted and blotched with black spots forming a dorsal and lateral, interrupted line along back and sides of the abdomen ; ventrum light. L : 9 mm. ; B. 4 mm. ; H. 3·5 mm.

Habits.—The egg is laid single amongst the flowers when they are in bud ; the little larva on emerging from the egg,—it eats its way out through the side as do nearly all these lycænine caterpillars—burrows into a bud and lives inside the flower, changing from one to another as it finds it necessary, eating the carpels and pistils. It eventually also pupates inside the flower or a flower-bud and, as often as not, falls to the ground with it, even before the change takes place. Sometimes it leaves the fallen flower and pupates on the ground under leaves, &c., or in a small crevice or hole. The attachment is by the tail and a body-band. The larva is sometimes attended by ants. The food plant upon which the first specimens of the butterfly were bred was *Butea frondosa*, the Flame of the Forest or, in the vernacular, Pallas. The tree or shrub is well known from its masses of rose-vermillion blossoms, each over two inches in length, and its deep green-black, velvety calyx. The flowers come out when the tree is leafless and it is one of the most striking objects that attracts the eye in the smaller, opener jungles of India—a sudden burst of flame in the dun landscape of the dry, hot, leafless months of February and April. There are other plants also in the flowers of which the larvæ may be found and they are all, as far as is known, of the same family as *Butea* : *Leguminoseæ*. Some of these are : *Pongamia glabra* or the Indian Beech, *Crotalaria* of different species, to which belong the Indian Hemp and so on. There is nothing particularly characteristic about the habits of the larva to differentiate it from the most of the others belonging to the same subfamily except, perhaps, that it generally feeds inside the flowers which it rarely leaves and pupates on the surface of the ground as often as not. The butterfly is a fairly strong flier and the male attracts notice by the glint of its deep metallic-blue upperside in the chequered sunlight under the trees that grow along the sides of tanks and water nallas which constitute its favourite haunts in the dryer parts of the country. As a matter of fact it does not occur in the very dry or desert tracts but, otherwise. is found all over

India, Burma and Ceylon. The trees that form its foodplants—by the way *Xylia dolabriformis*, also leguminous, is also one—are of fairly high stature and, therefore, the butterfly is found flying at all heights; but, none the less is it often to be caught close to the ground—but it is the males that are oftenest thus captured. The females seem to be somewhat scarcer, though by no means uncommon. The resting position is normal, with the wings closed over the back. The distribution of the speecies is: Peninsular India, except very dry or desert tracts; Ceylon; Assam; Burma; Tenasserim; the Andamans: extending in the Malayan Subregion to Australia.

Figures 41 and 41a of Plate G represent the male and female butterflies respectively. The colour is too dark and, on the undersides, too pink; the white lines on the undersides of the wings in the male are two indistinct, the costal margin of the hind wing on the upperside is too white. The blue colour on the upperside of the female wings is altogether wrong; it should be lighter and is not at all metallic.

151. Jamides celeno, Cramer.—*Wet-season brood.*—Male (Pl. G, fig. 42). *Upperside*: pale bluish-white, the discs of both wings bare of hairs, the inner margins fringed with long, white hair. The white markings of the underside show through by transparency. Fore wing: terminal margin narrowly edge with black that broadens slightly towards the apex of the wing; the veins along the costa slightly black, the base of costa brown; *cilia* dark-brown, the top half slightly lighter, the extreme base often narrowly lighter still. Hind wing: uniform in colour except for an anteciliary, thin, jet-black line edged on the inner side somewhat obscurely by a white line within which and touching it is a row of black spots, the spot in interspace 2 often being the only well-defined one but, generally, two, much smaller, often geminate marks in interspace 1 (sometimes represented by a simple brown line) and a blacker. small mark in interspace 1a followed above by a short, brown line; *cilia* rather light-brown white at the bases in the interspaces. Sometimes the black edging to the termen (outer margin) of the fore wing is much reduced and the subterminal series of spots on the hind wing may be nearly absent. *Underside*: greyish-brown with the following markings across the fore wing, beginning from the outside on the terminal margin: the *cilia* light-brown, the basal half pure-white, with a darker line running through the middle: a narrow, dark-brown, anteciliary band or broad line; inside this are the following white lines: two subterminal, parallel, from vein 7 to inner margin, quite parallel with the outer margin, interrupted narrowly at the veins, a little broader than the anteciliary, brown line and separated from each other by a distance double that breadth, the ends in interspaces 1 and 2 always widened, especially of the inner lines; a similar line, at right angles to vein 5, from vein 9 to vein 3, often at the lower end, touching the inner of the subterminal pair, sometimes well separated from it; generally very well-defined along its inner edge by darker shading than the ground-colour; a postmedial (postdiscal) line, parallel to the preceding, from vein 10 to vein 1, well-defined outwardly by brown to vein 3 and inwardly beyond; a pair of short lines, one on each side of the discocelular nervules between the top and bottom limits of the cell, sometimes parallel to each other. sometimes not quite. sometimes parallel to the postmedial line, sometimes converging towards it, both these short lines with dislocated, short continuations on the costa from which they are separated by an unmarked interspace; the inner of the discocellular pair of lines sometimes continued to vein 1 as a straight line, sometimes converging towards the postdiscal line at the end or, very occasionally, actually meeting it on vein 1; often, also, not in continuation with the inner discocellular line but dislocated to half way between the two discocellulars. Below vein 1 the ground-colour is pure white. Hind wing: a large, generally well-defined, subterminal, jet-black spot in interspace 2, broadly crowned and laterally surrounded by orange and touched with metallic blue-green scales inside the edges; a black dot similarly placed on each side of vein 1, the one in interspace 1 crowned by orange and speckled with blue-green scales; the following markings, beginning from the outer margin:—*cilia* light greyish-brown, the bases pure-white, the middles dusky; the anteciliary, brown band or line and two subterminal white lines as on the fore wing but the inner of these lines very much more irregular, more lunulate and the space between it and the outer dark-brown in interspaces 3-5, the line itself ending at vein 6, the last section in interspace 5 dislocated inwards and the anal portions interrupted by the spots in interspaces 1 a, 1 and 2; an inner, subterminal line starting from the margin at the extremity of vein 7, broken and moved outwards at vein 6, running thence, parallel to the outer submarginal line, interrupted by orange crowning of the anal spots and coalescing with the next interior line before the anal margin; this interior line (call it the outer postmedial) is more or less straight from vein 7 on the costa to vein 4, then often more irregular, running as a white border along the tops of the orange crowns of the anal spots and turning up in interspace 1 (from the middle of it in a curve) to strike the hinder margin in interspace 1 b at an acute angle; an inner, postmedial line from vein 7 straight to vein 4, slightly converging towards the outer postmedial, then dislocated inwards (sometimes as much as to form a prolongation of the outer discocellular line) and continued down to mix up with the lines beyond and turning up also to the inner margin; a medial, short line outside the discocellular (the outer one of the discocellular pair); an antemedial line from vein 7 continued by the inner, discocellular line more or less regularly and straight, then often dislocated outwards at vein 3 (or at the median vein which forms the bottom of the cell) and continued in the shape of a '3' turned the wrong way into interspace 1 where it describes a bend out and back again to run up, parallel to the lines already described, to the inner margin; in interspace 1 b there is a line parallel to it quite separate from anything else; there are two subbasel lines, more or less regular, straight and parallel from vein 7 to vein 1 and at their ends separated from them by interspace 1 b, there are two short lines in interspace 1 a which may converge on to the anal margin or be nearly parallel to each other, &c.; and, finally, a basal, white line which is often difficult to see. The net result of these lines is a pattern of short bands or pairs of lines, the outer 3 converging towards the anal angle and turning up toward the anal margin. A thread like tail of slightly over 3 mm. at the extremity of vein 2 black, tipped white. Antennæ brownish-black, banded thinly white, these bands interrupted narrowly above and below; the club plain brownish-black; palpi black above: white below with the extreme base black and the tip of the second joint black and white. Head with the frons black with a central, white line; the eyes rimmed with white, hairy; vertex with a dusky-black tuft. Thorax blackish covered with blue-white scales and hairs; abdomen ditto, blue-scaled at base, yellowish at extremity; below: head, thorax and abdomen pure white. Female.—(Pl. G., fig. 42a). *Upperside*: ground-colour paler than in the male, often quite white; terminal, black edging to wing very much broader, broadest at apex, the inner edge diffuse. Hind wing differs from the male as follows:—costal margin above vein 6 dusky-black, a postdiscal, transverse series of dusky-black, connected lunules often more or less obsolescent; followed by a series of black spots set in a background of the white ground-colours; anteciliary line and *cilia* as in the male. *Underside*: similar to the male, often yellower or with a fulvous shade; the markings precisely similar. Antennæ, head, thorax and abdomen as in the male; the last joint of the palpi, however, twice as long: as long as the second joint—in the male it is only half as long. Expanse: 28—40 mm.

Dry-season brood.—Male. *Upperside*: bluish-white, slightly more metallic and shining than in the wet-season specimens. Fore and hind wings: the markings of the underside show through by transparency; both wings with slender, anteciliary, black threads, edged on the inner side, on the fore wing, by a series of small, black dots (often all coalesced into a narrow band) that posteriorly are more or less obsolete and, in the hind wing, by an ill-defined, white line. *Underside*: ground-colour variable, greyish-brown to ferruginous-brown. Fore wing: a broad, dark-brown band along the discocellulars; a postmedial, similar band from costa to vein 3; below vein 3 a third band, similar in colour, to vein 1 or beyond, its borders starting, the inner in continuation with the inner border of the discocellular band or dislocated towards the outer border, the outer edge in continuation of the inner edge of the postmedial band or variously dislocated from it; this band below vein 3 having the edges nearly parallel or variously converging, sometimes actually meeting in interspace 1a; all three bands edged with white and forming together a rough Y-shaped figure; these markings superposed on a slightly sullied-white area from the inner margin upwards, replacing the brown ground-colour in varying degree; above the edges of the two bands, the arms of the Y, are continued to the costa as short, white lines placed often obliquely: terminal markings consist of a pair of transverse, sublunular, subterminal, white lines and a terminal, ill-defined white line, the spaces between these and a generally more or less obsolete anteciliary line darker than the ground-colour. Hind wing: crossed by the following transverse bands of a shade darker than the ground-colour and all edge more or less clearly with white lines, all irregular, broken and dislocated; a basal and a medial band, the latter band posteriorly curved sharply upwards and inwards toward the inner margin; a discal, irregular band of black that bulges outwards in the middle; terminal markings as on the fore wing but the terminal, white line more or less obsolete; in interspaces 1a, 1 and 2 are black spots inwardly crowned with orange, the spots in 1a and 1 minute, that in 2 largest. Antennæ black, shafts with white rings interrupted above and below; head, thorax and abdomen pale-brown; thorax and base of abdomen bluish-white. Female—*Upperside*: ground-colour paler and whiter than in the male, the marking on the undersides of some specimens more clearly apparent on the upperside by transparency than in the male. Fore wing: a very broad black, terminal margin, broadest at the apex and apical portion of costa of which it occupies about a third, posteriorly it narrows to the tornus, sometimes disappears just before the tornus. Hind wing: As in male but with a postdiscal, transverse, lunular line and a subterminal row of spots dusky-brown. *Underside*: much as in the male but the transverse, dark-brown bands somewhat straighter. Expanse: 33-40 mm.

The above description of the dry-season brood is more or less the absolute transcription of Colonel Bingham's *Lampides pura*, Moore and accurately describes the cold-weather form (generally called the dry-season) of *Jamides celeno* as it is found in the Kanara District of the Bombay Presidency where thousands of the insects have been bred. Colonel Bingham's wet and dry-season forms of *celeno* are all wet-season butterflies, that is, butterflies, the larvæ of which have had young-succulent flowers and leaves to feed upon.

Egg.—Shaped-like a turban, the flat top slightly concave in the centre of which is a rather large cell about one-sixth of the whole breadth of the egg in diameter; the whole of the top covered with minute, fine-walled cells which are more in the nature of reticulations than anything else because the walls are so low and thin; the central large one covered with similar, but far more minute, reticulation-like cellules; the sides with two and a half or three rows of much higher and coarser-walled, proper cells with a prominence, rather large, thick, flattened above and below, rectangular and round-topped, at the intersection of each wall, these prominences specially developed just before the top of the sides; about 22-24 cells round the whole circumference. Surface shining, especially the bottoms of the cells. Colour very light greenish with the cell-walls and prominences pure white. B: 0·75 mm.; H: 0·33 mm.

Larva.—The *shape* is quite normal, of more or less equal height from segment 4 to 10, sometimes ever so slightly highest at middle, also of more or less equal breadth from 5-10 but often seemingly very slightly broadest about segment 11—the larva can vary shape somewhat; segments 13, 14 forming a broadly rounded extremity to body, sloping slightly from front to back and considerably flattened dorsally; segment 13 not at all apparent except indeed it is represented by the part anterior to a short, dorsal curved, transverse dent; segment 2 forming the front of body, for the head is always hidden under it, semi-circular in shape, constricted on the dorsoventral margin from just before the hinder margin somewhat, the absolute front inclined to be square, the whole segment transversely convex, ascending more or less in a straight line to hinder margin, the actual front being shortly steep like the rest of the free margin, the dorsal depression situated towards the hinder margin from which it is separated by one-third the distance that separates it from the front margin; this depression occupying about half the length of the segment, triangular in shape, equilateral, with the base along hinder margin and slightly convexly curved towards it, the surface bluish and somewhat convex and set with star-based, minute hairs like the rest of the body but having no larger bristle at lateral angles; segment 3 shorter than 2, suddenly higher than it all along the margin, dorsally flat for its whole length and breadth, sloping slightly down towards 4; segments 4, 5 about as long as 3 sloping up in the dorsal line towards 5, 6 respectively; segment 6-10 all a trifle longer than 5 and coequal among themselves. *Head* completely retractile under 2, the neck, however, long enough though the head is never protruded further than the top of the clypeus at the most; round in shape though somewhat broadest just below the vertex; surface shining smooth, bare; clypeus triangular, about two-thirds as long as head is high, the apex acute, not rounded; colour of head very light watery yellow; clypeus finely brown-bordered; labrum red-brown with white base, transverse; ligula large, transverse, broadly oval, the front margin shallowly emarginate, widely so too, also red-brown in colour; antennal joints and mandibles light like the head, the last dark-tipped and toothed; eyes disposed: five in a curve of which the 6th is the centre: the two uppermost larger, glassy-colourless, the rest black. *Surface* extremely finely shagreened-granulate under the lens, shining; covered all over very densely in some specimens with minute, star-shaped tubercles, some milky-white, others green, others brown, all more or less sessile but a few with very short cylindrical stalks, each one bearing, issuing from its centre, a longly conical, curved, transparent glass-like shining, hair (or hollow structure ?); each star is separated by a distance of about 2-3 × its own diameter from the next; the conical hairs as long as 2-3 × the length of the star-base; sometimes the stars are well developed, sometimes badly developed; in some cases the hairs are shorter, also a few brown and straight; the brown of the larval colour is always caused by the star-bases being brown; there are some longer hairs rising also from starbases surmounted by short cylindrical tubercles, the hairs on the front margin of segment 2 the longest, 6 × as long as the transparent, glistening, curved hairs, more or less simple but sometimes with a minute bristle or two on their surfaces; these longer hairs some longer, some shorter, extending to near the hinder margin of segment: there are 2 such long hairs on the dorsoventral margin of segment 3, and some round the margin of segment 14: most of these long hairs are red-brown, a few light; the gland of segment 11 large, transverse, mouth-shaped and curved slightly when opened a bit—the inside is bluish-white when opened—and the organs of segment 12, situated diagonally below the spiracles and behind them, have circular openings of 2 × the diameter of the spiracle and are generally green like the surface so that, when quiescent they are difficult to see; when the cylindrical, protrusible body starts coming out it is pure, dull white and, when full out, has the rounded, somewhat dilated extremity clothed sparsely with minute, radiating bristles which bunch together when withdrawn; the length of this cylinder is 4 × its own diameter and 2 × the diameter of the opening; just behind the gland and for the length of the gland are some small, glassy-shining, circular, slightly convex tubercles; each segment 3-10 has a dorsal, central, small, shallowly funnel-shaped indent; there is also a long, lateral one on the same segments reaching from the dorsolateral region to the spiracle, the spiracle, in fact, being situated in the bottom of it; segment 12 nearly flat, altogether lower than segment 11 owing to the tumidity of the gland on that segment; segment 13-14 occasionally with some 4-6 little pits on the dorsal surface; ventral surface: there is a distinct, impressed and continuous line all round the body separating the dorsal, visible, upper half of larva from the under parts; the immediate lateral border below that line ventrally is like the dorsal surface: covered with the same star-tubercles and also the same colour, also it is segmented like the rest (it forms a sort of pedestal or foot for the body so to speak): where there are prolegs this pedestal forms the real base of the proleg, there being a second piece in prolongation: then comes the real leg (or what is called that) with the foot attached. *Spiracles* are quite circular, extremely slightly raised, with a very fine, thin, chitine-margin. the inside shallowly funnel-shaped; dull milky-white with a bluish tint and pitted; small; on the segments 2-10 situated in the bottoms of depressions. *Colour* bright grass-green with a show of a dorsal, darker line with brown touches on it on segments 10, 11 and anteriorly, occasionally, on segment 5; there may be a light, subspiracular line which is, however, generally not present: the ventrum is naked, with a stray hair; the legs are colourless; the prolegs with the feet also colourless and the row of hooklets along the edge or lobes red, the lobes are separated by a little white, fan-shaped body, prominent and shining: the *pseudonychium* or *empodium* ? L: 12 mm.; B: 4 mm.; H: 3. 5 mm.

When just out of the egg, the little larva is whitish and the head dark, and not retracted under segment 2; also there are subdorsal and dorsoventral rows of long hair. In the next stage appears a rose-coloured dorsal line as well as a lateral and submarginal one and a short diagonal dorsolateral line on each segment. These reddish lines or bands may subsist right through but, with the growth, become dimmer with each change; in the end they are as often as not quite obsolescent, or even wanting in the pure-green larvæ; some larvæ are much darker than others because of the clothing of tubercles being denser and more pigmented.

Pupa.—The *shape* is quite normal; rather stout, stoutest at the abdominal segments 7/8; highest at thoracic apex; segment 6 ever so slightly convex longitudinally. *Head* hidden, all except the smallest portion of the vertex, under segment 2, the frons large and high in a plane at right angles to the longitudinal axis of the pupa, the mouth-parts and clypeus ventral, the antennæ reaching the ends of wings and gradually broadened towards the tips, the legs reaching only half way to the ends; segment 2 large, about one-third the length of thorax in the dorsal line, convex transversely straight in the dorsal line ascending to thorax at an angle of 35° to longitudinal axis, the front margin a more or less semi-circular curve from shoulder to shoulder with the central part: the dorsal region say, between the dorsolateral lines more or less straight, perhaps a very little concave-emarginate, the actual dorsal line with a very small, triangular emargination: segment 3 or thorax humped-convex, somewhat gently compressed just above the shoulder with the shoulder only slightly prominent and rounded, front slope rising in the same plane as that of segment 2: 35° to a point (it is all rounded) about half way towards the hinder margin—perhaps a little less, the hinder slope gentle to the end of segment 4, the hinder margin triangularly rounded and apex produced into segment 4, meeting the wings in a broadly-rounded, rather deep angle of about 70°; segment 4, rather largely visible laterally, about half segment 6 in length dorsally: segment 5 about half segment 6 in length—or half segment 2—rising gently to middle of segment 6 but not reaching the height of thoracic apex: segment 6-11 about coequal in length, the first somewhat convex longitudinally as well as transversely; abdomen stout, stoutest at segment 7/8 which is the broadest part of the pupa; the dorsal line of abdomen thence to end is a quarter-of-a-circle-curve; end hemispherically rounded, not as broad as segment 2 at extremity, the portion composed of segments 12-14 dorsally perpendicular to longitudinal axis of pupa; segment 14 turned under somewhat, the suspensory hairs few and quite ventral. *Surface* very minutely rugosely reticulate all over, even including the wing-surfaces, the gland-scar on segment 11 evident; covered all over with very minute, erect, light hairs, very short even under the lens; rather sparsely disposed, most numerous on the head, segment 2 and dorsum of thorax and there also slightly branched. *Spiracles* of segment 2 more or less linear, slightly curved, situated along the curved hinder margin of segment 2, raised, shining, extremely light-yellow in colour and pitted coarsely—they are just like sausages cut in half longitudinally; the rest of the spiracles are slightly raised, broad, whitish ovals and are rather small. The *colour* of the pupa is a light, soiled yellow with a rosey tint except on the wings and head; speckled brown all over; a catenulated more or less dark-brown, dorsal band from end to end, somewhat broadened out on segment 2; a more broken, supraspiracular, similarly coloured band widening out into black, triangular patches on the wing line at segments 4 and 5 and on shoulders. L: 10 mm.; B: 4. 5 mm.; H: 3·5 mm.

Habits.—The egg is laid single on flowers, flower-stalks or in the axils of the very young leaves; the little egg-larva, eating its way out through the side, settles down in the axil of a rib or nerve of the young leaf with the midrib and is not easy to see it is so small;

also it wanders a good deal just at first; in the case where the eggs are laid on flowers it generally feeds inside the flower. Later on, when larger, it lives on the undersides of the leaves, always feeding and living on the young ones except driven to eat tough foliage. Many larvæ are often found on one tree. Pupation takes place for preference on or near the ground on the underside of a withered leaf, in a crevice of the soil, under a stone-ledge, &c.; the chrysalis is attached rather weakly by the tail and fixed by a body-band and, when touched, gives vent to a quick succession of thin creaking noises which are quite audible if listened for. The ordinary foodplants are *Pongamia glabra*, the Indian Beech. a tree of wide habitat; *Abrus precatorius*, the Praying Bean or Gunji, a common climber of weak habit, occurring throughout the Bombay Presidency and producing pods that contain, when ripe, bright scarlet, round beans with one end black which are commonly used by the local goldsmiths for weighing gold—not that these seeds are in the least of equal size or weight. Other foodplants are *Saraca indica*, the Ashok; *Butea frondosa*, the Flame of the Forest; *Heynea trijuga*: and doubtless there are others. All the above are leguminous plants with the exception of the last which belongs to the *Sapindaceæ*. The butterfly is one of the commonest in India, existing everywhere except in the absolute deserts, from sea-level up to 5,000′: jungles, plains, hills, open country, heavy rainfall or light, it matters not. Outside India it is found in Ceylon, in the Andaman Islands, Assam, Burma, Siam, Malay Peninsula, Java, Borneo and the Philippines. It has a weak flight, always keeps near the ground, generally near vegetation in the shape of hedges or bushes, does not bask or go to flowers much, flutters about the foodplants for quite long periods at a stretch without resting and sits with its wings closed over its back; it is not particularly fond of sunlight and sunny places. The female is just as plentiful as the male and is just as often seen. They are both easy to catch with a net, and are conspicuous objects when on the wing.

The insect is depicted on coloured Plate G, figure 42 being the male and figure 42a the female. The figures are good representations of the so-called wet-season brood except that the white lines showing through from the underside on the upper surface are too distinct although, in nature, they are always more or less visible. The undersides are. as usual, just a shade too pink.

Genus—CATACHRYSOPS.

There are three species of *Catachrysops*, all common insects where they occur; two of them, *strabo* and *cnejus*, very like each other on the underside, the third *pandava*, quite different. All three are some shade of purple or blue on the upper surface, more or less uniform in the males but in the females with a broad, black border and a lighter base and disc; the two first having the underside grey while the last has it brown. The two first have a very wide distribution and are true butterflies of the Plains though they may both be found more sparingly, also, in any open ground in the jungles and hills, even when the open space is circumscribed and surrounded by high forest; they range from Australia through the Malay Archipelago to Burma and China, and are found in the Nicobars, the Andamans, Ceylon and throughout India; *cnejus*, indeed, goes still further afield to the South Sea Islands. *Pandava* is more restricted in its habitat, not being found further east than Java practically; and is much more confined to the damp parts of its range. This last species has distinct dry-and wet-season forms, whereas the others have not. They are all three quick flies but *pandava* cannot compete with the other two in this respect—it does not affect flowers much either, whereas the others do; all three suck moisture from damp places on the ground but, otherwise, *pandava* is more addicted to sitting on bushes and trees. They bask with their wings slightly separated and rest with them closed over their back. The life-histories of the tree species are known and are described below. The larvæ and pupæ are all similar and the former are attended by ants; those of *pandava*, perhaps, more assiduously than the others. The larvæ all feed upon leguminous plants and both they and the pupæ are absolutely normal in shape.

152. Catochrysops atrabo, Fabr.—Male (Pl. G., fig. 44).—*Upperside*: pale violet with, in certain lights, a blue, slightly silvery sheen caused by a close clothing of long, approssed, white hairs all over the wings. Fore wing: a slender, anteciliary, dark line and a fringe of pale blue hairs along inner margin. Hind wing: interspace 1 with a short, transverse, subterminal brown bar or blackish spot edged inwardly faintly with white; interspace 2 with a prominent, round, black spot edged very faintly on the inner side by a diffuse bluish lunule and crowned often faintly with orange; the dark, subterminal spots of the underside apparent through transparency; an anticiliary, slender, jet-black line more conspicuous than in the fore wing, in some specimens edged inwardly in the posterior interspaces with white; this line is present in interspaces 1 and 2 in all specimens. *Cilia* of both fore and hind wings white transversely traversed near the base by a brown line; tail black, thread-like, tipped with white. *Underside*: pale dull grey. Fore wing: a short, narrow, transverse band on the discocellulars; a small, round, subcostal spot in interspace 10, a transverse, discal band that extends from veins 1 to 7, the portion below vein 3 dislocated and shifted inwards; a transverse, subterminal, ill-defined band and a terminal series of inwardly rounded spots, each of which subapically fills an interspace, greyish-brown; the discocellular and discal bands edged inwardly and outwardly by white lines, the subcostal spot encircled with white and the subterminal band and terminal spots edged on their inner sides with the same colour; lastly, a dark greyish-brown anteciliary line. Hind wing: a subbasal spot and a spot beyond it in interspace 7, a large, round, subterminal spot crowned with ochraceous in interspace 2, two geminate specks subterminally in interspace 1 and a terminal similar speck in interspace 1 a black; the spots in interspace 7 encircled with white; a lunular spot in middle of cell; two elongate spots in transverse order below it; a short transverse band on the discocellulars and a very irregular, transverse, broken, sinuous, discal band dark greyish-brown, edged inwardly and outwardly with white; beyond these is an inner subterminal series of greyish-brown lunules followed by an outer subterminal series of similarly coloured spots, the latter encircled with white, and a black anteciliary slender line. Antennæ. palpi, head, frons white and black, thorax and abdomen dark brown, a little purplish on the thorax; the shafts of the antennæ ringed with white, the club tipped with orange; beneath the palpi, thorax and abdomen white: (Pl. G., fig. 44a.) Female.—*Upperside*: fore wing: costa, apex and termen broadly brownish-black, the latter edging aft are enclosing a postdiscal, subterminal blue lunule, and lines in interspaces 1, 2 and 3 ; rest of the wing whitish, with no hairs on the disc, flushed and overlaid especially at base with metallic blue. Hind wing: costa and termen broadly fuscous or brownish black, the rest of the wing whitish flushed with metallic blue as on the fore wing which, however, does not spread to the dorsal margin ; a discal, curved, medial series of fuscous spots ; a transverse, incomplete, postdiscal series of white, sagittate lunules followed by a subterminal series of spots as follows, superposed on the brownish-black terminal border : two dark-brown geminate dots margined inwardly and outwardly with white ; a large, black spot crowned broadly with ochraceous inwardly and edged slenderly with white on the outer side in interspace 2, and anterior to that a transversely-linear, dark-brown spot encircled with white in each interspace. *Cilia* of fore wing brown, of hind wing white traversed by a transverse medial brown line. *Underside* : ground colour and markings as in the male. Antennæ, head (frons white and brown), thorax and abdomen similar to those of the male Eyes in both sexes hairy. Expanse : Male and female. 27·38mm.

Larva.—Normal. *Head* hidden under segment 2, small, round, labrum white, dark fuscous-brown in colour ; segment 2 tumid round margin with a large, central, dorsal depression ; the whole body depressed-looking, the whole margin of body somewhat tumid-looking ; front of larva—front of segment 2 that is—rather square ; segment 2 is, on the whole, trapeze-shaped, the longest side being the hinder margin ; the anal segments slopes gently to the somewhat broadly rounded extremity ; body thickest in middle. *Surface* dull, covered all over with little, brown, spine-like hairs which have got several, still smaller branch-spines at their bases, the apex above these branches being simple—these hairs and their branches very distinct on segments 2, 3 where they are somewhat more densely crowded than elsewhere ; a row of simple hairs round the margin of body. *Spiracles* oval, nearly round, flush, white. *Colour* of the larva green with a dorsal, brown line dilated on segments 4, 5 and on segments 10-14 ; a short, diagonal, whitish. subdorsal line on all segments and an indistinct, spiracular line or pair of lines besides : the larvæ may be plain apple-green, the anal end tipped black. L : 11·5mm. ; B : 4 mm. or a little more.

Pupa.—Normal in *shape* ; like that of *Nacaduba* or *Lampides bœticus.* Broadest about segment 5, highest at segment 8 ; narrowing gradually down to the front end which is truncated and somewhat narrow and to the posterior end which is rounded ; *head* hidden under segment 2 from above all but a small strip of the vertex which is not hidden because of a triangular sinus in the middle of the front margin ; the thorax is slightly humped and the hinder margin is somewhat sharply rounded in dorsal region : shoulders evenly rounded. *Surface* minutely wrinkled and covered with minute, erect hairs or bristles hardly visible except under a lens and then only when looked at sideways. *Spiracles* of segment 2 linear-oval, raised, whitish-yellow in colour ; the rest are nearly circular, raised, whitish. *Colour* creamy, marked sparsely with blackish specks, a dorsal and supra-spiracular row of black spots, one to each segment ; a black dorsal streak on segment 2 and a crooked black line on the dorsal margin of each wing about segment 4, 5. L : 9mm. ; B : 3·5 mm. ; B at segments 2·2 mm.

Habits.—The egg is laid on the flowers, leaves or stalks and even on bits of rubbish close by the plant ; the larva generally lives on the flowers, pods or young parts which it eats. The pupation takes place on the surface of the ground or, practically, anywhere and the fixing is, as usual, by the tail and a body-string. Many eggs are often laid on a single plant but few come to maturity as they are much parasitized by micro-ichneumons. There are probably many foodplants but one of the commonest is a thin twining, leguminous creeper called *Cylista scariosa* which occurs everywhere in plenty, both in the open and in the jungles. Any leguminous plant would probably do as well for the butterfly is very common throughout Peninsular India and it is very variable in the shade of blue in the males. It is very strong on the wing and has the same habits as *C. cnejus*. Colonel Bingham gives the distribution of the species as "Peninsular India south of the outer ranges of the Himalayas; Ceylon; Assam; Burma; Tennasserim; the Andamans; Nicobars; extending through the Malayan subregion to Australia." It can always be distinguished from *C. cnejus* by its hairy eyes and the invariable presence of a little subcostal dot in interspace 10 just inside discal band on the underside of the fore wing.

The male and female are depicted on Plate G, figures 44 and 44a. The upperside in the male is too blue; the colour of the underside not light enough; the spot on the costa between the discocellular short band and the discal band is not shown; in the female the shades are better and the costal spot is correctly shown.

153. Catochrysops cnejus, Fabr.—Male (Pl. G., fig 50)—*Upperside*: pale brownish-purple suffused with a bluish shade, apparent only in certain lights and no appressed hairs on the disc; a fringe of blue hairs along inner margin. Fore wing: a slender, black, anteciliary line edged on the inner side narrowly with fuscous dark-brown, broader at apex than at the tornal angle. Hind wing: a subterminal, black spot in interspace 1 and another similar spot in interspace 2, the two spots subequal in size, edged on the outer side by a white thread and on the inner side with ochraceous, more prominent in the spot in interspace 2; a slender, anteciliary black line with an inner, narrow margin of diffuse fuscous brown. *Cilia* of both fore and hind wings pale brown at base; tail at apex of vein 2 of the hind wing black tipped with white. *Underside*: silver-grey, in some with a pale yellowish, in others with a faint brown tint. Fore and hind wings: each with the following brown spots edged slenderly on either side with white: a transverse elongate spot on the discocellulars; a transverse discal series of six spots straight on the fore, bisinuate on the hind wing; on the latter wing capped near the costa by a prominent, white-encircled, round, black seventh spot; an inner and an outer subterminal, transverse series of spots, of which the inner subterminal series on the hind wing is lunular, the outer rounded; the white edging to both series being also lunular; both wings have very slender, anteciliary, black lines, and the hind wing, in addition, a transverse, curved, subbasal series of generally three, often four, white-encircled spots of which the spot nearest the costa is prominent and black, the others brown. Antennæ, head (frons white), thorax and abdomen dark brown, paler on the last, the shafts of the antennæ ringed with white, the thorax with a little purplish pubescence: beneath: the palpi, thorax and abdomen white.—Female (Pl. G., fig. 50a.).—*Upperside*: dark brown. Fore wing: a postero-medial somewhat triangular area from the base outwards for about two-thirds the length of the wing blue and a slender jet-black or brown, indistinct anteciliary line.

Hind wing: posteriorly from about the level of the middle of the cell slightly suffused with blue from base outwards for about two-thirds the length of the wing: a transverse, postdiscal, incomplete series of sagittate, white spots pointing inwards; followed by subterminal, transverse series of round spots, the anterior three dark brown encircled with bluish white, the tornal two jet-black, subequal, larger than the others, edged inwardly with bright ochraceous, outwardly by very slender white lines; finally, a jet-black, slender anteciliary line. *Cilia* of both fore and hind wings conspicuously white. *Underside*: ground-colour and markings as in the male, tornal two black spot touched outwardly with metallic bluish-green scaling. Antennæ, head, thorax and abdomen similar to those of the male. the shafts of the antennæ conspicuously ringed with white. Expanse: Male and female, 26-33 mm.

Egg.—Turban-*shaped*, depressed in the middle of the top; *surface* covered with a network of fine, raised lines, dividing it up into many four and five-sided cells, very minute on top in centre, decreasing outwards and downwards; the lines more or less diagonal with a prominent, coarse-topped excrescene or rising at each intersection, these risings hardly existing in the middle of the upper surface. *Colour* light green, nearly white, the lines and risings pure white. B: 0·5 mm.

Larva (Pl. II., fig. 21)—Normal. Segment 2 rather large, semi-circular, hiding the small, shining black, round *head* with the labrum white; dorsal outline rising to segment 4, thence descending gently to the anal extremity; increasing in width to segment 5, thence to segment 12 remaining the same; the anal segments flattened dorsally, the 14th ending somewhat broadly round-truncate. *Surface* covered with minute, white star-topped, shortly-stemmed, thickened hairs (stars 5 and 6 pointed); a few scattered, erect, white hairs; a subdorsal, central, longer hair on each segment; the dorsoventral margin fringed with sparse, fine, erect, long hairs, segments well marked by constrictions; gland on segment 11 and organs on segment 12 small. *Spiracles* oval, black. *Colour* apple-green, the anal end tipped with black; or dark rose, with a subdorsal line on each segment yellow, running slightly diagonally back and up, the two more widely separated at front margin than at hinder margin, that is, the dorsum between them darker coloured than the rest; a subspiracular, yellow band which is narrow on segments 5-9, broad on segments 10-14, sometimes also continued forwards to segment 2. The colour may be grey or nearly black but the yellow lines are always present. L: 12; B: 4 mm.

Pupa (Pl. II., fig. 21a).—Normal. Segment 2 more or less trapeze-shaped, rounded in front, thorax slightly humped, rather short, anal end rounded. *Surface* sparsely covered with minute, erect hairs, head with a few longer, porrect ones. *Spiracles* black, oval. *Colour* green; dorsal, longitudinal line on segments 1, 2 and some faint lines on sides of head, black; a dorsal, longitudinal, dark green line on thorax to anal end; some black dots on the abdominal, dorsal line, a black spot near shoulder and another just below it on wing. Or colour light rose with a patch on segment 2 and thorax, a dark irregular, broad, dorsal, longitudinal line the hole length of pupa, widening out into a smudge on segment 10 which is continued well down the sides; a black spot on each shoulder and the junction of the wing with the body on segment 5. L: 8 mm.; B: 4 mm.

Habits.—The eggs are laid singly on the flowers and stalk of flowers, generally in the axils. The young larva feeds upon the young parts; sometimes on leaves too when the eggs happens to be laid on a young leaf—it is always a young one, never old. There is nothing at all unusual in the behaviour of the larva and it is but sparingly attended by ants. The foodplant is *Ougenia dalbergioides*; but also other species of *Leguminoseæ*. *Ougenia* is a large tree locally in Kanara but, elsewhere, it is a medium sized one, called Tivas in Mahratti. It flowers profusely when leafless in the month of March or April and is then a delicate rose-white mass of small, crowded, sweetly smelling blossom. The butterfly is a strong flier, often rising high into the air and, possibly, going long distances at a time. It is fond of sunlight and greedy of the nectar of flowers for it seems to do little else but visit them in quest of food; it may also, often, be seen sitting on damp places on the ground sucking up the moisture. It is found all over India, Burma and Ceylon, in the Andamans, Nicobars and all through the Malayan Subregion extending to Australia and the South Sea Islands. It varies a good deal in size, chiefly because of the variety of plants the larva feeds on because, in many cases, it has been noticed, there is not enough food in the way of young parts to satisfy its hunger and it has to starve more or less in the last stage of growth. Especially must this be the case where the plant chosen happens to be a small vetch, the young parts of which are sometimes very scanty at certain times of the year. On the whole, however, there is little variation in the general patterns of the underside of the wing although there may be some in the tone: the subcostal spot in interspace 10 on the underside of the fore wing is never present and this serves to distinguish the species from *C. straba* with which it could otherwise easily be confused. The insect has been bred upon *Phaseolus trilobus* by Mr. de Nicéville in Calcutta and on *Cylista scariosa* in Kanara in Bombay.

The figures of the male and female 50 and 50a. on Plate G are not good as regard the colouring. The upperside of the male should be pale purple or violet. The blue on the uppersides of the female wings at the bases should be light and not dark; the underside should be light, a silvery-grey or, sometimes, with a slight pinkish or brownish shade.

154. Catochrysops pandava, Horsfield.—*Wet-season brood.*—Male. *Upperside*: lavender-blue. Fore wing: costa narrowly, terminal margin more broadly fuscous brown, the latter with in addition an anteciliary, black line: *cilia* light brown transversely traversed close to, but not at, their bases by a dark brown line. Hind wing: costa narrowly fuscous brown: a subterminal series of black spots outwardly edged or not by a white line: the spot in interspace 2 the largest and inwardly crowned or not more or less broadly with ochraceous yellow; an anteciliary, black line and the *cilia* as on the fore wing. *Underside*: greyish-brown. Fore and hind wings: the following transverse darker brown markings on each wing, the markings edged on the inner and outer sides with white lines—a short bar across the discocellulars, a discal catenulated band of six spots, the posterior two elongated spots of which on the fore wing are *en èchelon*, while the band on the hind wing is bisinuate and is capped anteriorly near the costa by a seventh round, black spot encircled with white; the above are followed by maculated inner and outer subterminal bands, which on the hind wing are curved and more or less interrupted on the tornal area by a comparatively large round black spot in interspace 2 and a smaller similar spot in interspace 1, both spots inwardly crowned with ochraceous; the white edgings on the inner side to both subterminal bands on the hind wing are more or less lunular; an anteciliary, blackish line bordered intermittently with white; *cilia* light brown. In addition on the same wing there is a sub-basal curved row of four white-encircled spots, of which the anterior two and the spot on the dorsum are black, the other dark brown. Antennæ black, shafts ringed with white; club tipped orange; head frons white and black, thorax and abdomen brown, the head and thorax clothed with bluish hairs; beneath: palpi, thorax and abdomen whitish. Female. *Upperside*: brown. Fore wing: shot with blue from base outwards for a little over half its length down its middle, this blue irroration not nearly extended to the costal margin; a slender anteciliary black line. Hind wing: blue like the fore wing but dark with a touch of blue iridescence near base; terminal markings much as in the male but the subterminal spots larger and often those in interspaces 1 and 2 more prominently crowned with orange and not extended beyond interspace 6; in addition postdiscally there is a lightening of the shade of the ground-colour, between which paler area and the subterminal spots the ground-colour assumes the form of a postdiscal, short, transverse lunular band. *Underside* as in the male, the marking slightly larger and more clearly defined. Antennæ, head, thorax and abdomen as in the male but slightly paler.

Dry-season brood.—Male and female. Very similar to the same sexes of the wet-season brood, but can be recognized by the following differences: —*Upperside*: Male. Ground-colour slightly duller; subterminal spots on the hind wing less clearly defined. Female. The blue shot area extended outwards on the fore wing for three-fourths of its length from base, but, as in wet-season specimens not reaching the costal margin; on the hind wing the blue suffusion covers the entire medial portion of the wing from the base to the subterminal row of spots, of which latter the spot in interspace 2 is entirely without the inner ochraceous edging. Male and female. *Underside*: ground-colour darker than in specimens of the wet-season brood, the discocellular and discal transverse bands on both fore and hind wings broader, the terminal markings very ill-defined, the inner white edging to the inner of the two subterminal transverse bands broadened and very diffuse. On the hind wing the discocellular and discal bands coalesce and form an ill-defined, diffuse, medial cloud on the wing. Expanse: male and female, 24-32 mm.

Larva.—Normal; segment 2 on the whole more or less semi-circular in outline but with a small indentation on front margin in the dorsal line, giving the impression of a truncation; the usual dorsal depression: segment 2 somewhat broader and higher than the preceding; the breadth of body after that the same up to segment 12 after which it decreases again to the rounded anal extremity; segments 13, 14 with the dorsal line sloping down at an angle of 30° to the longitudinal axis of body. The *head* small, round, shining, with a small, triangular clypeus; black in colour with the antennæ white, hidden under segment 2: the colour may be yellow. *Surface* of the larva is dull and rough looking; there is a central, dorsal depression to each segment which is more or less in the nature of a wide pit; the segment-margins are well marked; the whole dorsa of segments 13, 14 are distantly pitted with pin-point pittings;

the whole visible part of the body (dorsal half somites) are covered thickly with minute, erect, black, pointed hairs which are only visible under the lens ; there is a fringe of comparatively long, fine, white hairs along the dorsoventral margin on segments 2, 13, 14 and some similar ones along the sides of ventrum just below this line on the rest of the body : all erect ; the gland on segment 11 is transverse, mouth-shaped, rather large, surrounded with black tubercles ; the organs on segment 12 are rather small protruding at intervals a white, cylindrical column with a globular end covered with minute, short hairs. *Spiracles* circular, small white with thin raised edges. *Colour* of larva is either green or rose. One was green with a dorsal, lateral and subspiracular, broad line and indistinct, diagonal, similar markings between the dorsal and lateral lines ; there is always a subspiracular, yellow line along the dorsoventral margin as well a dark, pulsating, dorsal line—even when there are no reddish markings ; ventrum and legs always green. L : 12 mm. ; B : 4·5 mm.

Pupa.—Normal. The *head* is bowed, the whole frons being nearly ventral ; segment 2 with the dorsal line rising at 45° to longitudinal axis of body ; a broad strip with waved hinder margin ; the thorax with the anterior two-thirds of its dorsal line in the same plane as that of segment 2, then curving to become parallel to that axis at the hinder margin ; a slight dorsal constriction behind thorax ; the hinder margin of thorax comes to a rounded point in dorsal line running into segment 4, and the ends meet the wings in a rounded, deep angle of 45° ; the thorax convex in the dorsal line, the abdomen also ; the ventral line is straight ; the greatest breadth is at segment 7 ; the anal segment is rounded at extremity and turned under. *Spiracles* of segment 2 are small, flat, longly oval, light in colour ; the others are round and rather convex, small, light yellow in colour. *Surface* of the pupa is quite smooth, except for some distant, extremely minute, erect hairs, somewhat shining, the gland scar rather large, the segments plainly marked. *Colour* is generally an olive-green with fuscous, irregular dorsal and lateral lines ; the veins on the lighter-coloured wings dark-brown. L : 8 mm. ; B : 4 mm. at segment 7 and 3 mm. at shoulders—from which it will be evident that the pupa thins somewhat rapidly forwards from the middle ; it is about the same height at the apex of the thorax that it is at the middle.

Habits.—The eggs are laid, always singly, on the young shoots and on the young leaves which are often red. The young larva eats its way out of the egg through the side and immediately proceeds to eat : at first the leaf-cuticle on the underside — where the egg is generally laid—and later on in more drastic fashion, as it grows bigger, from the edge in irregular little triangles and curves, the whole substance being consumed. Ants are always found with these caterpillars and, as far as noticed, are generally of the genus *Cremastogaster* ; though others also attend. Mr. de Nicéville noted *Monomorium speculare* and *Prenolepes longicornis*, the former 'a nasty vicious little insect, the latter a long legged, very active, quick-moving species which is very greedy of sugar and is common in bungalows. They are all species of small dimensions, especially *Monomorium.* Colonel Bingham says that the butterfly exists throughout Peninsular India south of the outer ranges of the Himalayas, but not in desert tracts and that it is somewhat local. It probably will be found to affect the better wooded parts of India only and especially the regions of fairly heavy rainfall, avoiding the localities destitute of vegetation of Malayan character and very scanty water supply. All along the Western Ghats in Bombay it is plentiful and is to be found all the year round in undiminished numbers, whereas the other two species, *C. strabo* and *C. cnejus*, are a great deal more in evidence during the fair weather months than in the monsoon season. *C. pandava* is not quite such a strong flier as these two and is slightly the smaller in size; it is not particularly fond of undiluted sunshine and open spaces and is not met with at flowers as commonly as they are. Otherwise the habits are very much the same in all stages. The species is found also in Ceylon; Assam; Burma and the Malayan Subregion adjoining. The foodplants vary but are generally belonging to the *Leguminoseæ*. *Xylia dolabriformis*, or Jamba as it is called locally in the Southern Mahratta Country, is the commonest in Bombay; and curiously enough, it has been bred upon *Cycas*, a garden plant of quite a different family by Mr. de Nicéville in Calcutta and by the writer in Karwar, on the sea coast of Kanara, in Bombay.

14. Genus—Tarucus.

This generic group has a wide distribution in the Old World, to which it is confined. There are three species occurring in British India, one being found from North Africa to Upper Burma; another from Africa to China and the Malayan Subregion; the third being confined to India, from Sikhim to the Nilgiris and Southern India generally. *Tarucus venosus*, Moore, is mentioned by Colonel Bingham as a fourth species confined to Northern India. He says: "I agree with the late Mr. de Nicéville that breeding experiments will probably prove that this form belongs merely to the dark, wet season brood of ordinary *theophrastus*."

155. Tarucus theophrastus, Fabricus.—Male. (Pl. G., fig. 51). *Upperside*: pale or deeper purple to violet with, in certain lights, a blue suffusion; the markings of the underside slightly apparent through transparency, the wing-surface bare of hairs on the discs; a fringe of longish, white hairs along inner margin. Fore wing: costal margin above vein 12 blackish; discocellulars with a transverse elongate, often broad blackish spot; a slender, anteciliary, black line. Hind wing: immaculate except for an anteciliary black line as on the fore wing. *Cilia* of both fore and hind wings dull sullied to pure white with a brownish-black band along their bases. *Underside*: white or yellowish with the following black markings:—Fore wing: an anteciliary line continued along the costa but not up to the base: a streak below vein 12 from base passing obliquely to the costa; a less obliquely-placed irregular streak across the cell with a spot below it in interspace 1 (or that streak continued into 1 and even 1a); a curved interrupted band beyond, that consists of a spot in interspace 9 joined to a transverse bar across the discocellulars, and detached from it (or not) a spot in interspace 2 that coalesces with another in interspace 1: following this are four upper discal spots two and two placed obliquely, the lower two often coalescent; a transverse, post-discal, more or less macular, curved band; and a subterminal, transverse series of six round equal-sized spots. Hind wing: an obliquely placed basal streak and a spot below it on the inner margin; a row of three spots across the cell and one at the inner margin at the end, the upper two spots much elongated ; a short bar on the discocellulars and an elongate, transverse, subcostal spot beyond and above it (sometimes divided into two) ; four discal spots, the upper two placed obliquely two and two (sometimes joined), the lower two transverse, closer in, coalescent : postdiscal band, subterminal transverse series of spots and anteciliary line as on the fore wing ; the postdiscal band lunular, all or some of the spots of the subterminal series with shining bluish metallic scales. *Cilia* as on the upperside ; tail thread-like, black, tipped with white. Eyes smooth. Antennæ, head (frons white and black), thorax black, abdomen black with white bands ; the palpi black ; the shafts of the antennæ ringed with white, the club orange inside ; the thorax with bluish pubescence ; beneath : the palpi (with the third joint black), thorax and abdomen white. Female—(Pl. G., fig. 51a)—*Upperside* : dark brown ; bases of the wings suffused with bluish scales, inner margin sparsely fringed white. Fore wing : the transverse, discocellular spot as in the male, but continued posteriorly by a black spot in interspace 2 coalescent with a similar spot in interspace 1 (in some specimens the latter two spots are only seen by transparency from the underside) : a medial area beyond apex of cell white, crossed by an upper discal, macular, short, black band that extends from vein 3 to vein 6 ; the ground-colour over the rest uniform ; on the costal margin there are some pale lines between veins 10, 11 and 12, and on the broad terminal margin of ground-colour an obscure, transverse, macular, white line. Hind wing : basal, cellular and discal markings of the underside more or less apparent through transparency ; a postdiscal and a subterminal, transverse series of white, somewhat quadrate spots, the two series converge and meet anteriorly in interspace 6, the outer of the two is margined by the series of black subterminal spots of the under side which show through more or less plainly. *Cilia* of both fore and hind wings and tail at apex of vein 2 of the hind wing as in the male. *Underside* : similar to that of the male, the ground-colour slightly more yellowish, the markings more clearly defined. Antennæ, head, thorax and abdomen as in the male. Expanse : Male and female, 22-31 mm.

Egg.—In *shape* like a turban, circular, the breadth greater than the height, the top flat and even a little concave. The *surface* is finely shagreened, covered with little coarse lumps very irregularly, these lumps longer somewhat than broad at the top, the top rounded ; each one connected with each surrounding one by a fine, raised ridge ; most of the cells (so to speak) left between the ridges are triangular, some, however, irregularly four or even five-sided ; there are about two rows of these prominences from base to the periphery, of the—top and about 25 of them round that periphery—it is difficult to estimate ; on the top the lumps become rapidly lower and finally disappear towards the centre, the lines also joining them becoming finer ; in the absolute centre there is a moderately large more or less circular space showing merely the ground-surface of the egg : shining, shagreened. The *colour* of the egg is a light sea-green ; all the prominences and ridges are enamel-white ; all the ridges run up the sides of the prominences to the white, rounded top. B : O. 5 mm. ; H : O. 25 mm.

Larva.—The larva is like that of *Cyaniris puspa* : in that it is of the same *shape* and is covered with little flattened, short, white, semi-transparent hairs, some of which, where particularly short, are star-topped ; there are two hairs on the centre of dorsum of each segment, one on each side of dorsal line, longer than the rest, cylindrical, curving towards each other and nearly meeting at the points, with a few similar shorter ones in front of them ; as also a fringe of equally long, similar hairs round margin of body. All these hairs are set with minute, appressed hairlets. The *shape* is onisciform, rounded at both ends (the head being hidden under segment 2), broader in front than behind, broadest at segment 4/5, flanged on margin, the spiracles being well above the flange; each segment is slightly constricted at margin; the anal segment is perfectly convex; not flattened in any way; and the body is highest about segment 3/4 and descends in the dorsal line evenly thence to both ends. Segment 2 is semi-circular in shape and is higher at hinder margin than at front margin where, like the rest of the body margin, it lies closely applied to leaf surface; segment 3 is somewhat suddenly higher than segment 2 dorsally at the common margin of the two segments. The *head*, rarely visible, is roundish, smooth, shiny light green in colour; with a large triangular clypeus; labrum and jaws red-brown, eyes nearly black; antennal basal joint light green, second joint brownish. *Surface* of body dull with the usual transverse folds: one in centre of each segment and the segment margins; the mouth-like organ on segment 11 is transverse and large; the circular organs on segment 12 are present. The *colour* of the larva is green, rendered glaucous by the presence of all the little whitish flattened hairs; with a dorsal yellowish-white (sometimes centred with deep red and touched externally reddish) band as well as another subspiracular on margin of body and some short, diagonal, hardly visible, whitish bands on each segment laterally; the dorsal band spreading out on segment 2 into an obsolescent patch. Larvæ have sometimes a rosy tinge along the dorsal line and margin of body. L: 11 mm.; B: 4 mm.

Pupa.—The pupa is of the ordinary *shape* of the genera *Cyaniris, Polyommatus, Catochrysops*: ovoid, flattened ventrally, very gently and widely constricted at segment 4/5, convex dorsally and humped at thorax. It is rounded at the anal end where the last segments are turned under, the cremastral surface being ventral, rather large, oval with a ring of minute hooklets all round; the *head* is bowed towards ventrum and is hidden under the hood-shaped second segment which is somewhat trapeze-shaped in outline, though the corners are rounded; the thorax is large, evenly convex, highest about middle, produced forward in a gentle curve and backwards in a stronger curve more or less triangularly; the angle formed by it, wings and segment 4 being deep, open and curved. The *spiracles* of segment 2 are indicated by a slight raising of the hinder margin of segment 2, forming a long, narrow, pinkish-yellow surface facing backwards; the other spiracles are small, nearly round, prominent, white. *Surface* of pupa is nearly smooth except for a patch of minute, erect, light hairs laterally on segment and somewhat shiny. *Colour* is green, very light on wings; with a dark dorsal line marked with black, and a black supraspiracular spot to each segment 3 to 12 with another similar spot above it on segments 4 to 12; at times may be nearly completely suffused with black. L: 7 mm.; B: 3 mm.

Habits.—The larva lives generally on the underside of young leaves, eating the substance of the leaf, all but the upper cuticle, in lines; is generally attended by ants (*Cremastogaster*) and goes down to the ground to pupate though it sometimes changes in a curled up, dry leaf on the bush or tree, the ants still guarding it in this state. The pupa is, as usual, fixed by the tail and a bodyband. Several larvæ are often found on one bush or tree and their presence is easily seen by the characteristic method of eating and, generally, by the attendant ants. The thin upper cuticle left after the under substance of the leaf has been eaten, withers, shrivels and turns brown in a short time, when it shows very distinctly against the green of the rest of the upperside. Ants are very greedy of the exudation from the gland of the caterpillars and, very generally, may be found clustering on their backs in numbers. The species that have been particularly noticed in attendance are *Camponotus compressus*, Fabr., a large, black species. more than half an inch in length; and *Cremastogaster* of undetermined species. It is more than probable there are also others. The butterfly is a low-flying insect of fairly rapid movements but it never flies far before settling again. It sits on the uppersides of leaves with its wings closed over the back and is constantly rubbing the two hind wings together; it walks about a good deal, also, amongst the flowers and on the leaves and does not seem to visit flowers much for food. It is found everywhere, in the hills and plains, in the jungles and open desert tracts in Northern and Western Africa, Arabia, Persia, Baluchistan, N. W. Himalayas, the Punjab, Western, Central and Southern India, Ceylon, Assam, Upper Burma. It occurs thus in Sind where the annual rainfall is only 2 inches in some parts, and in North Kanara in Bombay where it reaches 300 inches locally.

The pictures of the male and female, figures 51 and 51a on Plate G, are both too dark in the colour of the blue on the uppersides; the male should be pale purple to violet, the female should have the blue at the base lighter blue. Both undersides are generally whitish though yellow is not uncommon.

156. Tarucus plinius.—This form closely resembles in both sexes on the upperside *T. theophrastus*, but the character and disposition of the markings on the underside are completely different, but is less blue and browner on the upperside, the disc bare of hairs and the fringe of the inner margin is blue in both sexes.

Male. (Pl. G., fig. 45).—*Upperside*: dark brownish-violet with, in certain lights, a rich blue suffusion, and the markings of the undersides (in both wings) showing through by transparency. Fore wing: no discocellular black spot, so conspicuous in *T. theophrastus*; terminal margin with a narrow edging of fuscous black, widest at the apex, gradually decreasing to the tornus, followed by an inconspicuous, anteciliary, jet-black line Hind wing: costal margin slightly but broadly shaded with fuscous, which is continued as a slender, anteciliary, black line to the tornus. *Underside*: white. Fore wing: with the following brownish-black markings:—an irregular edging along the costa to near the apex from which extends downwards a subbasal band, broadened across the cell and below it; an irregular band that extends along the discocellulars and below them to interspace 1 where it ends in a point; an upper, discal, curved band of more even width, but dislocated below vein 4, the lower portion of it shifted inwards forms a large, quadrate spot in interspace 3, below vein 3 the band is continued downwards by two small, inconspicuous spots, beyond this is a very short, acutely-pointed, comma-shaped mark; a very regular, evenly curved, complete, transverse lunular line, a transverse series of subterminal spots and an anteciliary, slender line. Close to the base of the wing extended obliquely upwards and outwards from the dorsum is a triangular mark, the edging of white colour left near the base forms above the apex of this mark an acute angle; between the band that crosses the middle of the cell and the transverse, discocellular band is a more or less slender, irregular, similarly-coloured line; and between the discocellular and upper discal bands another much shorter line that extends from the costa downwards but does not reach vein 4, this is slightly clavate anteriorly and posteriorly. Hind wing: mottled with brownish-black that leaves only basal, subbasal, medial and discal transverse lines or bands of the ground-colour; the medial and discal bands, which are highly irregular, enclose here and there small brownish markings, the bands themselves coalescing above a very irregularly shaped, brown mark that is placed on the posterior half of the middle of the wing; terminal markings as on the fore wing but the subterminal spots larger, the apical one especially so, the tornal two spots jet-black and each encircled by a glittering, slender ring of metallic, green scales. *Cilia* of both fore and hind wing, the antennæ, head (frons black) thorax and abdomen much as in *T. theophrastus*, except that the abdominal white bands do not reach the dorsum. Eyes haired. Female.—(Pl. G., fig. 45a). *Upperside*; very closely resembles that of female *T. theophrastus*, but the extent of white on the fore wing is greater so that there is a greater area of white to be seen between the brown markings superposed on it, these markings have the appearance of an irregularly formed V on a white background. Hind wing much as in *T. theophrastus*. *Underside*: similar to that of its own male, but the brown bands less broken, more regular. *Cilia*, antennæ, head, thorax and abdomen as in the male. Expanse: Male and female, 22-31 mm.

Egg.—Turban-shaped, slightly depressed on top in the middle, has about 24 low, rounded ridges running from the centre on top in slightly curved lines diagonally to the base in both directions—that is to the right and to the left—so as to divide the surface up into many little diamonds; at the intersections of these lines are small, raised knobs, one to each intersection, which are many times higher than the ridges; the bottoms of the little diamond-cell—the surface of the egg—is extremely finely reticulated; the cells on the top of the egg are very small, confused and undefined. The colour of the egg is nearly white throughout and only slightly shining. B: O. 5 mm.; H; O. 3 mm.

Larva.—The larva is of the usual limaciform *shape* of the genera *Nacaduba*, *Cyaniris*, &c.; it is broadest about segment 5, each segment is constricted at margin, most so on dorsum where each segment is somewhat humped in consequence, the highest part of hump being near the anterior margin; the greatest height is also about segment 5; the anal segment is somewhat broad (in larval transverse sense), the humping very slight from segment 11 hind margin to anal margin, the anal portion somewhat suddenly narrower than segment 12 and broadly rounded at end, the dorsal portion being flattish, but the margins thick (no depression on dorsum however); segment 2 is semi-circular in shape, with the dorsum raised including nearly the whole length of hinder margin but coming to a bluntly rounded portion at front margin; the centre of this raised triangular part being slightly depressed; the sides of larva are of course sloping from dorsum to larval margin; each segment has a depression from near dorsal line down centre to near each spiracle: rather slight. The *head* is small, the neck when protruded very long; the colour of head is black, very shiny, labrum whitish, antennæ brownish: clypeus large and triangular; shape round. The *surface* of the larva is dull, with the segmental margins constricted as stated above, a depression down centre of segments 3 to 11; the usual round openings with white cylindrical tubes protrusible on segment 12; the mouth-like, transverse gland-slit on segment 11; the whole surface besides covered with minute, sessile star-topped hairs, white on the white portions, black on the brown. The *spiracles* are small, white, roundish, flush, The *colour* of larva is green with a red-brown dorsal band from end to end interrupted at front of segment 3 by a yellowish-white margin to that segment which ends and curves back broadly along the dorsal band in the dorso-lateral region ; segment 4 is also yellow in the dorso-lateral region ; segment 5 is red-brown in that region with a thin line of yellow sub-dorsally along dorsal band ; each succeeding segment is whitish in that region (owing to the white tubercles), there being a diagonal, indistinct, white stripe also in the lateral region ; there is a marginal, yellowish line more or less bordered with red-brown above somewhat broadly but often interruptedly. The belly is flat and green. L: 10 mm. ; B: 3 mm.

Pupa.—The pupa is of the ordinary *type* of that of *Castalius*, &c. ; has the thorax very little humped, so that the dorsal constriction behind it is little ; there is no lateral constriction ; the pupa is broadest about segment 8 and also highest there ; segment 2 is broadish, quite straight as to front margin, curved back on sides towards thorax, with its dorsal line in the same plane as that of front of thorax ; the head or face is perpendicular to longitudinal axis of pupa ; the thoracic dorsal line ascends gently to centre and then gently descends to hinder margin of the segment, that margin being curved strongly towards segment 4 with an inclination to being pointed on dorsal line ; the angle between it and wings is open and fairly deep, widely rounded ; the anal end is rounded, the segments 13 and 14 being turned under ; the dorsal line of abdomen rather convex. *Surface* of pupa shiny and covered, with exception of wings, with minute, erect, yellowish hairs, fairly densely. *Spiracles* of segment 2 long, narrow ovals, yellowish ; others, small roundish, whitish. *Colour* light brown-pink speckled and blotched all over rather strongly as a rule, the markings having a tendency to run into a dorsal and lateral band. L: nearly 8 mm. ; B. 3·5 mm.

Habits.—The eggs are laid singly and, as a rule, on the flower-heads when in bud ; more rarely in the fully expanded heads ; sometimes, even, on the flower-stalks. The larva, on emerging, eats into a bud ; later on, when more grown, it lives on the outside of a bud, eating the inside, for which purpose, presumably, it has been supplied with its long neck ; it never seems to eat leaves. The pupation takes place in a crevice in the bark of the tree ; rarely among the buds ; the attachment is by the tail and a body band as usual. Some of the larvæ are plain green in colour, others are as the one above described ; others again have the red-brown greatly extended, covering nearly all the green colour, but never the yellow of the dorsa of segments 3, 4 and 6-10, nor the subspiracular, yellow, band which is always present though it is, in the very red-brown specimens, often narrow and interrupted. The pupæ are nearly quite plain when they belong to the plain green caterpillars. The larva is, seemingly, but rarely attended by ants.

Numbers of the butterflies were bred in Karachi in August 1904 when the *Albizzia lebbek* was in full bloom. Males were flying about in numbers in the shade of these trees everywhere as also round the tops—looking for females of course—in the hottest of suns. They fly strongly and for a long time in much the same manner as *Catochrysops pandava* or some of the *Nacaduba* species. They sometimes light on the ground where there is little doubt many pupæ are to be found as the flowers fall in great numbers and, with them, larvæ must come down too. When at rest on a leaf in the sun, the wings are often kept partly separated though, in absolute repose, they are joined over the back in the usual way. De Nicéville says the insect "is extremely pugnacious, fighting with others of its own species whenever it meets them, and ascending high into the air during the contest. It settles chiefly on bushes and trees, seldom on the ground." He further quotes Aitken as having bred it on *Sesbania aculeata* which also belongs to *Leguminoseæ*; and Green in Ceylon on *Plumbago capensis* of the *Plumbaginaceæ*. Mr. Green remarks that he has never seen ants attending the larvæ. They do occasionally attend them as, indeed, the presence of the gland and extensible organs on segments 11 and 12 would seem to indicate. Like many other lycænid caterpillars, this one may require ants, and that may account for two such very dissimilar foodplants as *Sesbania* (or *Albizzia*) and *Plumbago*. The insect has a wide range: West Africa, Aden, throughout India, Ceylon and Burma and into the Malayan Sub-region. In Bombay Presidency it does not occur in regions of very heavy rainfall and has never been met with in Kanara, on the Ghats or at sea-level. Mr. Aitken, however, above mentioned, bred it in the island of Bombay.

The figures of the male and female, Plate G. 45 and 45a, are rather good; the upperside of the male is perhaps somewhat dull.

157. Tarucus ananda, de Nicéville.—This has generally, so far, been placed in the genus *Castalius*. It is an undoubted *Tarucus*.

Imago.—Male. *Upperside*; dark purple with a gloss in certain lights, with narrow, uniform, black, marginal borders to both wings; the spots of the underside generally showing through the wings which are bare of hairs on the disc and the fore wing has hardly any fringe on the inner margin. *Underside*: dull white, markings black. Fore wing; with a band under vein 12 from the base to the costa before the middle; a bar from the middle of the costa to the middle of the wing; on its inner side there is another broad bar extending hindwards to vein 1, and it sometimes touches the second bar above, sometimes does not; a postdiscal, macular band, with the spots sometimes joined together, sometimes more or less well separated. Hind wing: with the basal and subbasal, transverse bands, sometimes broken; a short discocellular band; a postmedial usually of three pieces; both wings with subterminal and anteciliary, uniform rows of small spots, the one in interspace 2 often larger and touched with metallic blue-green scales outwardly. Antennæ black, ringed with white; eyes smooth; head and body black above, white beneath; club of antennæ black; frons black; the palpi black above, white beneath where the fringe of the second joint is white mixed with black.

Female like the male. *Upperside* with the ground colour dull, browner, and with a blue gloss at the bases of the wings and along the dorsal margin very much paler, often white on the disc; the markings of the underside showing conspicuously through the wings. *Underside*: as in the male.

Expanse of wings: ♂. ♀ 25mm.

Larva.—The *shape* is, on the whole, normal though the body is depressed, reminding the observer somewhat of the larva of *Arhopala*. Segment 2 somewhat thickened on the margins, rounded in outline, slightly convex; each segment is quite distinct except segments 12-14; the anal end is rounded; each segment has a transverse, depressed line in the middle parallel to front and hinder margins from spiracle to spiracle so that it has the appearance of being a double segment. *Head* greenish-yellow and shining, with dark brown jaws and a jet-black eye-patch. The *surface* is covered with comparatively long hairs which are either thick-topped or pointed; the margin of the body under the spiracular region is set with a dense fringe of long, white, slender hairs above which are some long tubercular, lilac-coloured hairs, one to each of the segments 4-10; on segment 3 there are two such, one above the other; on segment two there are 12 in a double row round the free margin; each segment has 4 long, white, curved hairs more or less in the middle of the dorsum, 2 on each side of the dorsal line and these are knobbed at the extremity; segment 3 has, besides, a few drooping hairs, long and white; the whole surface of the body is covered, in addition, with thick-topped, white and dark tubercles; segment 11 alone is naked owing to the presence of the large, red gland; on segment 12 are found the usual circular openings through which can be protruded a cylindrical, white body, the top of which is set with minute tubercles. The *spiracles* are small, round and flush with the surface. The *colour* is grass-green with a golden glimmer, even when looked at with a considerable magnifying power. The following pattern dorsally: on segment 2, an hexagonal, black depression; segment 3 yellow-green bordered laterally by black; segments 4-6 black dorsally, segment 4 having a short, black line running down from the black; segments 7, 8 yellow bordered by black laterally and with a short, diagonal, black line below on each side; segments 9, 10 are similar to 7, 8 but are red-brown instead of yellow; the rest of the body dorsally black, suddenly narrowing on the anal segments—this marking is what makes the larva so like that of *Arhopala centaurus*. These markings make a broad, dorsal, parallel-sided band which reaches down to the lateral region or line. L: 11 mm. B: 3 mm.

Pupa.—Normal in *shape*. Segment 2 is straight in front with a slight notch in the dorsal line of front margin; anal end rounded, highest at thorax, broadest at segments 7 and 8. *Spiracles* white, small, round; the openings on segment 2 indicated by linear, white, slightly raised ovals. *Surface* more or less shining, with a few hairs laterally on front margin of segment 2 and a few on segment 4. Colour shining brown-black, sometimes with a greenish tinge; slightly reddish on the sides of the abdomen; wing-cases mottled with green and yellowish. L: 6 mm. B: 2·5 mm.

Habits.—The eggs are laid on plants infested by ants, generally of the genus *Cremastogoster* which attend the larvæ assiduously throughout their lives and the pupa afterwards. These ants build little byres or houses made of comminuted matter—the same as they use to build their large, globular or ovoid nest masses in the trees—in which they often tend these cows of theirs, for that is practically what these larvæ are. The latter no doubt take refuge in these places when they desire to change their skins. Originally these cells are made indubitably to cover stationary "mealy-bugs," which are so dear to most species of ants, and not for the lycænid; the butterfly certainly seeks out the places where these ants are and lays her eggs there, knowing they will be well looked after. The full-grown caterpillars are led down to the earth or into a crevice in the bark of the tree or into a hole by their protectors at the end when they are ready to pupate—at least it looks as if they were for they are always accompanied by many ants which climb all over them, ride on them and show every sign of attachment to them. Even in the pupal stage they are still attended and befriended. The larva is sluggish and not easily alarmed. It eats the leaves both below and above, but more generally above, in broad lines and patches; never, however, eating right through so as to make a hole. Wherever there is one, there are generally dozens. The plants it has been found on are *Loranthus* (Mistletoe) of various species, (*Loranthaceæ*); *Zizyphus* of several species (*Rhamnaceæ*); and a few others. The pupation is normal, the attachment being by the tail and a body-band.

The butterfly is rather a weak flier and often rests on the uppersides of leaves with its wings widely separated, basking in the sun; when in absolute repose it closes them over the back as usual. It does not like excessive sunlight and is found only in the regions of heavy rainfall of Sikkim, Orissa and Southern India. It is plentiful in the jungles of the Western Ghats of Kanara in Bombay where it occurs, but it cannot exactly be called common even there. The larvæ and pupæ are always much easier to find than the butterfly which, probably, keeps to the thick jungle and higher parts of the trees, although it has never been seen flying with the strong-winged, basking species of butterflies on the tops of hills where, in parts of Kanara, the piled masses of rock enable one to get on a level with the tree-tops.

The habitat of the species is Sikkim, Orissa, Southern India in Peint in Nasik, Kanara and the Nilgiri and Anamalai Hills, Assam, Khasia Hills.

15. Genus—Castalius.

"This genus cannot be separated from *Tarucus* by the venation or by structure and is, in fact, linked to it by coloration through *Castalius ananda*, de Nicéville, a slightly aberrant form," says Colonel Bingham. It is better in the genus *Tarucus* and has now been placed there. The antennæ are not quite the length of the fore wing, the club being long, gradual and slightly blunt at the apex; palpi pointing nearly straight forward or slightly up, densely clothed anteriorly with scales but not fringed; third joint of the antennæ long, needle-like and naked; body comparatively weak; eyes haired. The eyes are smooth in *Tarucus theophrastus* and *anandas* but haired in *T. plinius*. The larvæ of all of these, both genera, are very similar and so are the pupæ. The former are all covered with a dense clothing of thick-topped hairs which give the surface a shining, frosted appearance—except *ananda* where the hairs are, some of them, terminated by a drop-shaped thickening, instead of with a star or flattened end. *Castalius*, as a genus, is spread over Africa, India and the Malayan Sub-region. The transformations of the three species described here are known and are given below. There are 6 or 7 species known from the Indian region. The foodplant of the larvæ is always *Zizyphus* of the family *Rhamnaceæ*; various species such as *œnoplia, rugosa, jujuba*; each species of butterfly seeming to affect one particular species.

158. Castalius decidea, Hewitson.—Male. *Upperside*: dark brownish-black with a broad, median, oblique, white band across fore and hind wings, sometimes extended on the fore wing beyond vein 5 and produced outwards between veins 4 and 5 into a hook-like form, the top of this band looking rather like the head of a walrus. Fore wing: no appressed hairs on the disc and very little hair-fringe to the inner margin; *cilia* chequered black and white. Hind wing: sometimes with a series of white, marginal lunules included in the black colour in interspaces 1b, 1 and 2 where there is, then, also a black anteciliary line; *cilia* as in fore wing. *Underside*: white or yellowish with the following black markings:—extreme base black produced outwards along vein 12 in a small club-shaped mark into base of cell and connected in interspace 1a by a broad, brown bar with a broad, curved band running through the top of the cell to the costa before the middle, generally narrowest below; a broad, short band from costa after the middle, obliquely outwards down to and below vein 5; another short band, generally limited by vein 1 below up to vein 3 (sometimes beyond), postmedial; a more or less quadrate patch, submarginal, between veins 3 and 4; a marginal series of small, white spots or dots superposed on a terminal, black band expanding in a slight inward curve across apex. Hind wing: the extreme base of wing black continued by a conjoined, or not, spot in interspace 1 at extreme base, produced outwards and then up through base of cell to vein 8; a subbasal, black spot on hinder margin in interspace 1a; a broad, black band from hinder margin, medial, in interspaces 1a, 1 and 2, widening out distally; a large, postmedial spot in interspace 3, a smaller one beyond in interspace 4 and series of three conjoined spots in interspaces 5, 6, 7, that in 7 much the larger and produced broadly and shortly inwards; a subterminal series, one in each interspace, of black lunules joined at the ends to an anteciliary fine, black line; *cilia* of both fore and hind wings are really brown in their basal halves, whitish-grey above, chequered broadly black at the ends of the veins. Antennæ black, finely banded white, the club tipped orange; palpi black above; head black, the frons white, fringed on each side with black hairs; the eyes rimmed with white and haired on their surfaces; thorax and abdomen black above, the former with white hairs, the latter thinly banded with white. Below: palpi, head, thorax and abdomen white. The end joint of the palpi is slightly longer in the female than in the male. Expanse: 28-35 mm.

The above is more or less the description of a wet-season butterfly. They, however, vary a good deal even in the wet season in the width of the oblique-white band on the upperside and the size of the black patches on the underside. Some specimens have the veins crossing the white band on the upperside of the fore wing black.

In the height of the dry season the white of the upperside is much broader and occupies quite one-third of the fore wing and more than half of the hind wing, leaving, on the latter, only a very small, black base and a far narrower outer border with a sinus in the inner, medial part and a series of three, white, subterminal spots in interspaces 1b, 1 and 2. *Underside*: Fore wing: a black lunule just inside apex, leaving the apex itself white; an anteciliary black line with a submarginal series of lunules, their ends touching the anteciliary line—none of these terminal markings are present in the wet-season form; the black patch on the middle of the outer margin, the upper, postdiscal patch from the costa and the lower, postdiscal mark from the inner margin quite distinct and separated; the last and the outer marginal one are often joined in the wet-season forms. Hind wing: the basal and discal spots are quite small and altogether separated, the middle spots sometimes even altogether wanting.

Egg.—Shaped like a finger-bowl, the top concave, but only gently so; the surface shining, covered with extremely fine, comparatively large reticulations or flat-bottomed cells with a little lump at each junction of the lines; these cells are most probably more or less irregularly hexagonal as usual; they are largest about the widest part, *i.e.*, the rim of the bowl or cup and become smaller towards the centre of the top where is situated the minute micropyle which is circular and smooth; there are only about 2-3 rows of cells from rim to base; the colour is a delicate light green, the net-work and lumps white. B: 0.6 mm.; H: a good deal less.

Larva.—Is of the normal *shape* but very depressed, highest in the middle though the dorsal longitudinal outline is only very gently convex; there is a distinct flange separating the dorsal aspect from the ventral, this ventrum being nearly flat; the flange can be slightly turned up; the segments are well marked, being constricted laterally along the flange except in segments 12-14 which are, as is commonly the case, more or less one piece; here this end piece is broadly rounded at extremity and flat dorsally; the outline of the body seen from above is a lengthened ellipse as segment 2 is also rounded in front like the anal segment; this segment 2 is not retractable under 3 and has the dorsal trapeze-shaped space hardly depressed at all. The *head* is hidden under segment 2, is round in shape, light, shining, very pale yellowish with black eyes, red-brown tips to the mandibles; a large, triangular clypeus. *Spiracles* small, nearly white, nearly round, all the same size; that of segment 2 hidden between margins of 2 and 3. *Surface* dull, covered rather closely with shining silver-white, broad, more or less triangular, pointed, minute hairs more or less all over; amongst them some simple, feathered, longer, golden ones; some one or two subdorsal, much longer, erect hairs and a subspiracular fringe all round the body of still longer, erect, golden-brown ones; these last numerous, feathered also and about one-third as long as breadth of body. most dense at both ends of the larva: the gland near hinder margin of segment 11 transverse, mouth-shaped, rather difficult to see because of the hairs; the organs on segment 12 circular, about the size of the spiracles, whitish. *Colour* is light green—whitish looking; with a broad, light-yellow-green dorsal band flanked by a dorsolateral or nearly lateral translucent green, dark and narrower band, a spiracular light yellow-green band and the margin or flange below broadly translucent green; ventrum light green; prolegs whitish; true legs shining whitish with dark tips. L: 15 mm.; B: 5 mm.; H: 3 mm.

Pupa.—*Shaped* like that of the *Catochrysops* group but rather stout and flattened somewhat ventrally. The *head* is hidden, ventral: segment 2 semi-circular in front contour, very slightly and broadly indented in dorsal line on the front margin. convex transversely, the dorsal line at an angle of about 45° to the longitudinal axis; the vertex of head is at right angles to that axis and only the frons is ventral as a matter of fact; the thorax is somewhat narrow transversely, the front part of dorsal line starting at an angle of about 50° to longitudinal axis, this angle gradually decreasing to the rounded apex about the middle of thorax whence it descends again to segment 4 in a short slope of about 30° in the opposite direction; the hinder margin of thorax is a parabolic curve meeting the wings in a large, rather deep, rounded angle of somewhere about 45°; segment 4 is long laterally, short in dorsal line where it is about equal to the 5th segment in length; from the 5th inclusive, the dorsal line of pupa again rises to segment 7 which is about the highest point; the lateral outline also increases from shoulders to middle of pupa though there is no lateral constriction at all; the dorsal constriction is broad and gradual. The *spiracles* of segment 2 are considerably raised, oval and light pinkish-yellow; the others flush, lighter, small, oval. *Surface* of pupa more or less dull, covered all over with erect, nearly white (some tinged brownish especially at bases), long. slightly curved hairs; these hairs seemingly with many joints each, about as long as one-third the breadth of pupa at middle (or a little less) and not very dense, most numerous at both ends of the body; the ventrum naked; the anal end is nearly hemisperically rounded and there are no conspicuous glands—or 12th segment organ-scars. *Colour*: translucent light yellow; abdomen suffused narrowly along the segment-margins with pinkish brown; segments 1-4 and wings spotted with brown-reddish, dorsal line on posterior half of thorax black as well as the lateral corners of segment 5; a dorsal, longitudinal pinkish-brown line from end to end. Sometimes the pupa is pinkish, the wings, thorax, head and segment 2 soiled whitish-yellow. L: 9 5 mm.; B: 4·5 mm.; H: 3·5 mm.

Habits.—The eggs are laid singly in the axils of the leaf-venation on the underside. The little larva eats out of the egg irregularly near the top, but does not eat the shell as a rule. It lies at first in the axils of the veins of the young leaf where it is born and eats the epidermis; later on eats through the substance but always feeds on young leaves, never upon the old ones. It is never at any stage much attended by ants. When very small it lies amongst the fluff of the young leaf-surface which is very densely, softly woolly-hairy. When about to pupate the larva turns pinkish brown and the simple hairs—also some of the flattened ones,—turn dark golden brown; it settles down very flattened, in some convenient curve of a young or old leaf, often along a midrib and turns into the pupa, fixed in the usual manner by the tail and a body-band tightly against the surface. The butterflies are most numerous at the times of young leaf from the month of July to the cold weather in south of the Bombay Presidency. The imago appears within about a week after the pupation has taken place and, generally, eclosion takes place about 10 o'clock in the morning. later on very dull days. The newly emerged insect walks about slowly for a bit before flying and, at first, only takes very short exercises in the air a few yards or so, settling again to repeat its walking bouts. As a rule it never makes long excursions and never flies high but always keeps to the lower regions of the air not far from the surface of the ground: although its foodplant is a high-climbing species often extending over fairly high trees. The butterfly is fond of settling on bare, more or less dead or dry twigs and is then a fairly conspicuous object, with its wings joined over its back, white with large black blotches. It is not, on the whole, fond of the sunlight and might be called a species of heavy jungle and shade, like its congener, *Castalius ethion.* It has a wet-season and dry-season brood; really it has broods one after another through most of the year. The wet-season insects have the black border very broad and the white markings narrow; the dry-season specimens are characterised by a large extension of the white area. Some specimens have the underside with a decided yellowish tinge as in *Tarucus theophrastus.* The foodplant is *Zizyphus rugosa,* "Churn" or "Torn" in the vernacular, an extensive scandent shrub, climbing over large trees at times in the damp forest regions of the Western Ghats in Bombay, with clusters of small greenish-white flowers and three-veined, roundish leaves, very thorny and a general nuisance to the wayfarer in the jungles; the young leaves are brown in colour as a rule, saw-edge and with the veins prominent underneath. The fruits are white when ripe and edible, having a somewhat insipid taste and a mealy consistency; they are about the size of a marrowfat pea but are ovoid instead of round.

The distribution of the insect is given as Sikhim, Malda, Rohilkund; Orissa; Western and Southern India: Bombay, Poona, Kanara, the Nilgiris, Travancore; Ceylon; Assam; Burma.

The male and female are figured on Plate G, figures 47 and 47a. Both are good except that the undersides are not pure enough although specimens with a yellow shade are not uncommon.

159. Castalius ethion, Doubleday and Hewitson.—Male. *Upperside*: fore and hind wings: no hairs on the discs and no fringe of hair on the inner margin of fore wing, medially and obliquely crossed by a very broad, pure white band that is broadly edged on its inner and outer margins by dark shining blue and does not extend on the fore wing above vein 6, just above vein 3 it projects outwards for a short distance whence the inner margin of its dark blue edging is carried obliquely to vein 6; whence it runs down parallel to outer margin to inner margin; the extreme bases of the wings black; the costal margin of the fore and the terminal margins of both fore and hind wings broadly black: on both wings a light iridescent blue suffusion from base outwards. *Underside*: snow-white. Fore and hind wings: the following jet-black markings:—Fore wing: two broad more or less parallel streaks from base extended obliquely to the costa, the outer of the two the broader and apically curved inwards and, on the costa, coalescent with the inner streak; costal margin very narrowly edged with black; postdiscal, outwardly oblique, short bar, slightly clavate posteriorly. extends from the costa and vein 5; opposing this there is between the dorsum and vein 3 a similar but erect quadrate patch; beyond these there is an inner and outer transverse, complete, subterminal series of spots followed by an anteciliary slender black line; the spots of the, inner, subterminal series quadrate large, of the outer linear, the posterior two of the former very large; lastly, a single detached postdiscal spot in interspace 3 very close to the inner subterminal line of spots. Hind wing: a curved short basal band not extended to the costa, a spot touching it in the middle on the outer side (or a parallel bar) and a discal, transverse band twice widely interrupted (or continuous), the middle portion shifted outwards, the lower portion with a spot on its outer margin joined to it; subterminal and terminal markings as on the fore wing. Antennæ (ringed with white, club tipped orange), head (frons white, fringed black), palpi, thorax and abdomen black; beneath: the palpi, thorax and abdomen with a median, longitudinal, white line.

Female. *Upperside*: similar to that of the male, but the median white transverse band across both wings broader, extended on the fore wing up to vein 7 (or not) and with no inner edging of blue or iridescent light blue irroration; the black at the bases of the wings and on the margins not so intense in shade, more of a brownish-black. *Underside*: ground-colour and markings very similar, the basal two oblique bands on the fore wing generally farther from one another than in the male. A thread-like tail at end of vein 2 of hind wing, black tipped with white. Expanse: Male and female, 28-31 mm.

Egg.—Turban-shaped. The surface is only slightly shining; divided up into irregular, hexagonal cells by coarse walls which are lowest on top of the egg and nearly triangular, also smallest round the central micropyle; the intersections of the walls each with a rounded, raised knob; the bottoms of the cells flat and minutely pitted; sides of the hexagonal cells often of different lengths, sometimes nearly O so that two knobs nearly coalecesce, or even 3 at times; the rows of cells are diagonal and slightly curved, about 4 of them from the triangular cells of the top of the egg to the base —7 or 8 small ones surround the micropyle. *Colour*: green nearly obscured by the white knobs and ridges. B. O. 70mm.

Larva.—The *shape* is more or less normal though considerably depressed, the dorsal region quite even except that the segment-margins are quite distinct and except for the depression on dorsum of segment 2; this depression is somewhat indistinct and quite smooth at the bottom; segment 2 is semicircular in shape; the anal end is broadly rounded and not in the least flattened, its extreme margin perhaps slightly tumid. The *head* is hidden in repose under segment 2, green in colour, shining, rather small, the eye region jet-black, mandibles light red-brown tipped; antennæ, labrum whitish, ligula with a red-brown tinge. Spiracles hardly visible, being sunk in slight depressions, small, round and whitish in colour. *Surface* of body is shagreened silvery-white all over because of a dense covering of short, thick, silvery-translucent hairs, generally appressed, sometimes erect, sometimes thickened in the middle, sometimes double, always extremely short; these thickened hairs disposed all over the dorsal half-somites, most densely on segments 2 and 3; rather shorter and sparser on the green, dorsal line; down each side of the green, dorsal line is a row of 4-6 long and slightly up-curved bristles or hairs mixed with an equal number of shorter ones on each segment; all these bristles being light red-brown in colour; also a submarginal (dorsoventral) row of light red-brown slightly longer, down-curved hairs, about 12 to each segment. *Colour*: light grass-green with a broad, dorsal, dark-green line from front margin of segment 3 to hinder margin of segment 12, flanked on each side by a still broader, light yellow band, below which the body is light grass-green. There is no sign of gland on segment 11 or organs on segment 12. L: 13 mm. B: 3 mm.

Pupa.—Is normal in *shape*, like those of the other members of the genus *Castalius*. The *head* is high, that is the frons is vertical with part of the vertex of which a very small portion is visible above before the front margin of segment 2, this margin being more or less straight; the thorax is rounded and humped, nearly hemispherical as regards the dorsal portion of the somite; the abdomen is also convex about segments 8, 9 where the body is fattest both in height and diameter; there is a wide, though rather accentuated constriction at segments 4, 5; the anal end is somewhat narrowed and rounded. *Spirales* of segment 2 are longly oval and white in colour; the rest are small, inclined to be semicircular and are also white. The *surface* is clothed all over with short, erect, white hairs, longest at anal extremity and on segment 2. The *colour* is green touched with brown all along the borders of the wing; there is a dorsal brown line and a spiracular one; the segment-margins also brown. L: 10 mm.; B: 3 mm.

Habits.—There is nothing much to say about the habits in all stages for they are similar to those of other members of the genus. The eggs are laid singly on the leaves and nearly always on the undersides; the young larva eats in a similar manner to that of *C. rosimon*, so does the full-grown one; the pupation takes place on the underside of a leaf and the attachment is by the tail and a body-band; sometimes, rarely, it is formed on the upper surface. The larva is not ever, as far as observed, attended by ants. The butterfly is always to be found close to the ground, flying about the places where the foodplant is growing on the borders of partial clearings in the big jungles. It is never found in absolutely open ground, neither does it like dense shade. It behaves much like *C. decidea* and is easy to catch if it were not for the thorny character of the foodplant which interferes with the manipulation of a net. The foodplant is exclusively *Z. oenoplia* "a straggling shrub or large climber with single, hooked or rarely germinate spines, obliquely ovate or oblong-ovate leaves 1-2·5 in length, with copious, brown, silky hairs beneath; few-flowered, axillary cymes of light greenish-yellow flowers and small, black, edible fruits." (*Haines* in The Forest Flora of Chota Nagpur.) The young plants are erect like a young tree and the leaves are quite glabrous and thin in texture and it is chiefly on these young plants that the eggs and larvæ are easily to be found. *Zizyphus oenoplia* is a very large climber at times, is nearly evergreen and very common in regions of heavy and moderate rainfall. The eggs, larvæ and pupæ are much parasitized. The butterfly is confined to damp jungles where the rainfall is heavy, and will be found all along the ghats in Bombay. The male is a beautiful little insect easily recognised by the irridescent blue interior bordering to the black ends of the wings on the upperside. Its distribution is: the Western Ghats of Bombay as far south as Travancore; Ceylon; Andamans; Assam; Burma to Malay and Java.

160. Castalius rosimon, Fabr.—Male. (Pl. G., fig. 46)—*Upperside*: (bare of hairs on the disc) white. Fore wing: with hardly any fringe of hair on inner margin: costa, apex and termen edged with black, the edging much broader on apex and termen; base outwards for a short distance more or less densely overlaid with metallic blue scales which cover and make indistinct a large basal, outwardly-clavate, black spot; a transverse, black, oval spot on the discocellulars touching the black edging on the costa; an oblique, irregular line of four quadrate black spots beyond, the upper spot coalescent with the black on the costal border, the next spot below shifted outwards out of line, touching, as does also the lowest spot, the terminal black edging; posterior to this is a quadrate black spot in the apical half of interspace 2, and placed obliquely outwards from it coalescent with the terminal black border, another similar spot in interspace 1. Hind wing: three basal, black, somewhat coalescent spots overlaid with metallic blue scaling ; the costal margin above the subcostal vein and vein 7 black ; this colour filling also the base of interspace 6, where in some specimens it is divided into a basal portion with a spot beyond ; a postdiscal, curved, transverse, black band followed by a subterminal, transverse series of black spots, each spot edged inwardly and outwardly by very slender lunules of the white ground-colour ; on the inner side of the postdiscal band posteriorly is a broken line of four black, generally coalescent spots two and two, the two upper often touching the postdiscal band. *Underside* : white. Fore wing : a long oblique, black band under vein 12 from base outwards to the costa ; below and parallel to it an irregular, broad, black, somewhat conical mark ; following these are two outwardly oblique, medially-interrupted, black, macular bands ; the inner of the two extended from costa along the discocellulars, is then widely interrupted below its posterior portion that is formed of two elongate, coalescent spots and touches (or not) the inner, subterminal transverse line of elongate spots just above the tornus ; the outer, obliquely-placed line is subapical and medially broken, the middle portion consisting of a quadrate spot is shifted outwards ; finally, two parallel, subterminal, transverse series of black, elongate spots ; the inner spots broad, more or less rectangular, the outer series linear, the latter coalescent anteriorly with a slender anteciliary black line. Hind wing : a transverse, basal, black band, with an elongate black spot below it on the dorsum ; a transverse, subbasal line of four well separated black spots ; a transverse, oval, discocellular, black spot and, obliquely above it, three subcostal similar spots, the inner two coalescent; postdiscal and terminal markings consist, the former of four black posterior spots two and two, each pair coalescent and placed *en échelon*, the latter of a transverse double series of subterminal, black spots and an anteciliary, black line ; the upper portion of the postdiscal markings touches the inner subterminal line. *Cilia* of both fore and hind wings white alternated with black at the apices of the veins ; filamentous short tail to the hind wing black tipped with white. Antennæ, head, thorax and abdomen black, the shafts of the antennæ ringed with white and club tipped with orange, the head between the eyes (frons) and behind them white ; beneath : the palpi, thorax and abdomen white, the last barred broadly with white on the sides. Female : similar to the male but with the black markings on the upper and under sides broader. Expanse : Male and female, 28-34 mm.

Egg.—Hemispherical, white in colour, the surface finely reticulated with raised, thin lines forming cells, the intersections rising into high, round-topped cones with a minute depression on the top of each: 9 of these cones from top to bottom and 18 round the greatest circumference. B : O. 75 mm.

Larva.—Is of the usual *shape,* somewhat flattened, broadest about segment 4 with the dorsal line hardly convex from segment 4 to anal end ; segment 2 more or less semicircular in outline and slightly constricted at hinder margin, the dorsal depression hexagonal and long with its greatest length on dorsal line, its bottom slightly convex, greyish-blue and sparsely covered with minute, dark, star-topped hairs ; second segment not at all hidden by segment 3, nor suddenly lower than it ; the dorsal outline from front to hinder end is quite continuous and even except for the slight constrictions between the segments 2-12 ; segment 3 slightly broader than 2 and segment 4 than 3 ; breadth of body gradually diminishing thence to anal end which is broadly rounded; segment 13 short, hardly distinguishable from 12 or 14, the last with the 13th having the shape in outline of a quarter of a circle : organs of segment 12 large, circular, the protrusible cylinder or tube being white, with a thickened, subspherical extremity set with fine rather long hairs; the gland on segment 11 mouth-shaped, large, transverse, at hinder margin and, being the colour of the body, is not always very conspicuous; segments 13, 14 sloping at 30″ to the longitudinal axis, dorsally flattened. *Head* small and nearly white, round; surface shining, the jaws brown with a black spot inside the eye-curve; the clypeus is large and triangular. *Spiracles* small, round, white, flush; those of segments 2, 12 larger, oval. *Surface* of body extremely minutely hairy and shagreened and has a frosted appearance besides because of the covering of larger though still minute, sparsely disposed, silvery-white, short, star-topped hairs which, on the anal segments, are mixed with some brown minute, simple ones; there is a dorsoventral, single row of conspicuous, longer, light-coloured, slightly curved hairs all round the body, about 5 to each segment on each side, which rise from slightly more elongated star-topped hairs or tubercles—these hairs may be brown on segments 2 and 3 and all of them are about one-third or one-fourth as long as the body is broad; on segments 2-9 there are 2-4 erect, curved, dark similar, though, perhaps, stouter hairs to each segment one behind the other, all subdorsal; on the anal segments there are some few somewhat flattened, pointed, translucent hairs; and on all segments there may be groups of star-topped, brown tubercles more minute than the sparsely disposed, larger ones. *Colour* grass-green with a lighter, yellowish, subdorsal line or thin band (the dorsal space betwen often filled in with yellow and suffused with deep rose-brown in places) on which are the subdorsal hairs—which hairs, by the way, rise from conical tubercles; the broad dorsal band formed by the filling in with yellow is sometimes also bordered neatly with rose-brown in which case it contrasts strongly with the pure green of the whole of the rest of the larva. The tubercles of the subdorsal hairs are light yellowish in colour; ventrum darker green on sides. L: 11 mm.; B; 4 mm.; H: 2 mm.

Pupa.—Free marginal outline of segment 2 semi-circular, somewhat flattened in the middle; head completely hidden from above, high; the general *shape* of whole pupa normal, dorsal constriction behind thorax normal, the lateral constriction very slight: anal end rounded, segment 14 turned under; apex of thorax and segment 7 about the same height; the hinder margin of the former a semi-circular curve meeting the wing-line in a deep, broadly rounded angle of about 45 . *Spiracles* of segment 2 white, linear, slightly raised, the rest of the spiracles small, round, flush, white. *Surface* slightly shining, nearly smooth except for some slight, transverse, acicular lines and a covering, not in any way dense, of very minute, erect, pointed, simple hairs and star-topped ones mixed. *Colour* green, the wings lighter; yellowish on abdomen with a darkish green, dorsal line and an indistinct, yellow, spiracular line; a row of black, laterodorsal spots, one to each segment; a large dorsal one on hinder margin of segment 2; a dorsal, central one on segment 4: black, as well as the tips of shoulders and sprinkling of others more or less promiscuously. L: 7· 5 mm.; B: 3· 5 mm.; H: 3 mm.

Habits:—The egg is laid, always one at a time, among the red hairs in the axils of leaf-stalks, thorns or on a stalk, also on the leaves; the young egg-larva is very depressed in shape and white and feeds only upon the underside and substance beneath the upper cuticle of the young leaves; when full-grown, but not before, they eat the whole thickness through from the edge. It rests in the ends of the eaten passages or ways or in the axils of the veins on the undersides of the leaves and is attended in a desultory way by ants of the genus *Prenolepis*. It is sluggish, moving but slowly and does not easily fall, except when full-grown, when disturbed; then, of course, it is much more conspicuous and cannot hide in axils and similar places. The pupa is formed often on the underside of a leaf and is firmly attached by the tail and a body-band. These larvæ are very much parasitized by small chalcid wasps which pass over into the pupa whence they emerge in due course. The eggs are also similarly treated by micro-ichneumons. Some larvæ also are attacked by fungus and rot in the end. The butterfly has similar habits to *Castalius ethion*, though it is far commoner than that species and inhabits drier localities. It is a good flier though not very strong; quick enough on the wings though it does not as a rule go in for extensive flights; it rests on the upper surfaces of leaves and basks in the sun with its wings half open; it is fond of the sun and prefers light to shade. When at rest for the night it keeps the wings closed over the back like most of its relations and may be caught on grass-culms, &c., on cold mornings with the fingers in that position in open places. The insect has a wide range, being found throughout India except in desert tracts; Ceylon; the Andamans and Nicobars; Assam; Burma; and into the Malayan subregion as far east as the island of Timor.

Figures 46 and 46a of Plate G are fairly good representations but have the undersides too yellow; they should be pure white. The blue on the upperside of the male is, perhaps, too dark.

NOTE:—On examining the covering of the body of the larva under the microscope, the star-topped hairs are seen to be tubercular, thick-stemmed, cylindrical, branched into triangular teeth at the top (the star), the stem sometimes short, sometimes non-existent; from the centre of the star is extruded a transparent body shaped like a triangular paper bag with one side open, sometimes like a spear-head; these bodies can seemingly be withdrawn inside the tubercle at will; the stars are very numerous on the broad, dorsal colour-band, nearly non-existent laterally on the body where they are reduced to low tubercles with small extruded bodies like the others; the stars very thickly crowded occasionally on the dorsal band, the tubercles scattered on the sides; the star-tubercles on the dorso-ventral margin longer-stemmed; the long, simple hairs of the dorso-ventral fringe jointed-looking, occasionally minutely and sparsely feathered, all from cylindrical tubercles which are often minutely and sparsely spined.

16. Genus—LAMPIDES.

There is only one insect belonging to this genus, namely *Lampides boeticus*, the most widely spread of all the *Lycænidæ* except *Everes argiades*. It exists throughout the whole of the old world: Europe, Asia, Africa and Australia and the Hawaiian Islands. The eyes are hairy. Body slender, short. Palpi directed straight out in front in the female, directed upwards in the male, second joint overreaching the head by half its length, clothed with long, appressed scales; third joint long, slender and naked; legs slender; antennæ with a lengthened, grooved pointed club. The butterfly representing the genus is known in England as the Long-tailed Blue but it is rare and difficult to get there. The transformations are known and will be found below; the larva and pupa are altogether normal; the former feeding upon leguminous plants of various kinds. The butterfly is one of the commonest in India in the opener parts.

161. **Lampides boeticus,** Linn.—Male and female. The outer margins of wings with the parts between the veins outwardly convex. The bases of wings on the undersides blackish and powdered with white scales. Male. (Pl. G., fig. 48)—*Upperside*: violet-blue, the wings covered with white scale-like hairs over the ordinary scaling, which gives them a frosted appearance, only a very slight fringe of hairs to the inner margin of fore wing. Fore wing: costa very narrowly, termen evenly and more broadly brown. Hind wing: costa and apex broadly, termen very narrowly brown; interspaces 1 and 2 with, each, a more or less rounded, subterminal, black spot, the latter, the larger and blacker, each surrounded by an obscure ring of whitish or bluish of a shade lighter than the ground-colour. *Cilia* of both fore and hind wings silvery-white, with a brown line along their bases that becomes medial before the tornal angle of the hind wing; thread like tail black, tipped with white. *Underside*: pale greyish or brownish ochraceous. Fore wing: transversely crossed by the following more or less parallel, pale-brown fasciæ:—one pair across the middle of cell, another pair at the end of the cell, not extended above or below it, five beyond; the first two of the latter group broken at veins 2 and 3, the lower portions shifted inwards out of line with the upper portions; the next short, not extended below interspace 3 and narrowed to a point posteriorly; the subterminal two complete, curved, the outer one the narrower and macular. None of the fasciæ extend quite up to the costa. Hind wing: transversely crossed before the terminal markings by eight or nine pale-brown fasciæ similar to those on the fore wing but more or less fused and broken and the inner ones posteriorly curved upwards; these are followed by a comparatively broad band of the ground-colour; and broad, inner, subterminal, pale-brown fascia and an outer series of similarly-coloured spots; these markings posteriorly interrupted by a black spot in interspace 1 and another, larger, in interspace 2, the latter inwardly margined with ochraceous; both spots with superposed metallic bluish-green scales. Antennæ, head (frons white fringed with black), thorax and abdomen brown; the shafts of the antennæ ringed with white, the long flattened clubs orange inside, the thorax with some bluish-white pubescence; beneath: the second joint of palpi fringed black in front; its thorax and abdomen white. Female. (Pl. G., fig. 48a)—*Upperside*: brown; in some specimens with; in others without, some iridescent bluish scaling at the bases of the wings which sometimes extends outwards towards the disc. Fore wing: anteciliary black lines, and in a few specimens traces of an inner subterminal series of bluish spots in the interspaces more obvious posteriorly than anteriorly. Hind wing: a postdiscal, transverse, pale macular, fascia, often absent and always more obvious anteriorly than posteriorly, followed by a subterminal series of white ringed spots, the posterior two of which are jet-black and always present, the anterior one crowned with orange; the anterior spots brown, of a shade slightly darker than the ground-colour and not always present, though in most specimens fairly well indicated; lastly, a prominent anteciliary black line. *Cilia* of both fore and hind wings white with a line of brown along their bases. *Under side*: as in the male. Antennæ, head, thorax and abdomen similar to those of the male but paler on the upperside. Expanse: Male and female, 34-38 mm.

Egg.—Turban-*shaped,* flat on top and at bottom, depressed in the central third of the top; *surface* shining, very minutely granulated covered with irregular 4-5- and 6-sided cells with fine, thin, low walls, at the corners of each cell is a raised thick-topped excrescence or knob of varying height; the diameter of these cells decreases on the flattened top from the circumference to the micropyle in the centre until, immediately around it, there is no sign of them. The *colour* is light green with the ridges and knobs white.

Larva.—Woodlouse *shaped* and normal. The segments are well-marked; the lateral outline is oblong from segment 3 to segment 10, the dorsal line is fairly convex, segment 2 low and flat with a large, central, 4-sided depression at each lateral corner of which is a minute, black tubercle; the shape of segment 2 is semicircular; the shape of the anal segments is sloping dorsally, where it is also flattened, the extremity narrowing and eventually curved or rounded; segment 3 is suddenly somewhat higher than segment 4; segments 3—10, both included, have 5 indentations on the surface, one small, round and dorsal, the others—lateral, longitudinal and one above the other—somewhat changeable with the motions of the body; there is no sign of gland or organs on segments 11, 12. The *spiracles* are situated in the bottom of the lowest longitudinal depression, being very light brown in colour, small and round. The *surface* is covered with very minute, appressed hairs, sometimes shining, sometimes a few brownish ones; the dorsoventral margin with similar, erect hairs, longest round the anal margin. The *head* is hidden under segment 2 but has a long neck, the colour being shining yellow with a black-margined clypeus and black eye-patch—sometimes it is said to be altogether black or ochraceous pale brown. The *colour* of the larva is either dull or bright green or rose with a double, dorsal, yellowish line and a subspiracular, similar one; it may be plain green with a darker dorsal and subspiracular line or it may be tinted with rose and even have diagonal, lateral lines. L: 11 mm.; B: 4 mm.

Pupa.—In *shape* exactly the same as that of *Jamides bochus* except that the anal end is more broadly rounded; the abdomen is broader than the breadth at shoulders; there is no constriction at segment 4; the thorax is rounded and slightly compressed; segment 2 is square in shape seen from above, its front margin is gently curved, the head beneath it high. The *spiracles* of segment 2 are small, oval, yellow. The *surface* is smooth, shining. The *colour* is dull or bright green, with a darker dorsal line, a double row of subdorsal, black specks and, some-times, a lateral double row also; the colour may be greyish with more plentiful black dusting and marking. L: 8 mm.; B: 3·2 mm.

Habits.—The egg is laid on the buds (and stalks) of flowers into which the little larva, on emerging, immediately eats. It feeds upon the carpels and generally avoids coming out into the open; when full-grown, however, it has to come out and then feeds upon the young pods, resting on their outer surfaces. When flowers are still on the tree, it prefers the enclosed, tender carpels and often falls to the earth with the blossoms; the pupation then taking place in a crevice of the soil or on a clod of earth, &c. The pupa is attached rather loosely by the tail and a body-band as usual. The butterfly is exceptionally strong on the wing and flies long distances at a stretch, is fond of the sunlight and may be found in any open land (or, indeed elsewhere) seeking refreshment amongst the low herbage in grasslands and scrub jungles in the dry season in India. It often lights on the ground and is fond of flowers and surface moisture. It has been bred on the flowers of *Butea frondosa* known as the Flame of the Forest; on *Crotalaria capensis*, on the Common Pea, *Melilotus* and on other leguminous plants, devouring the seeds. This is the Long-tailed Blue of England where it is, however, rare. It is found throughout Southern Europe, Africa, almost throughout Asia except in the very North, right away to, and also in, Australia.

The figures 48 of the male and 48a of the female on Plate G are both two dull and dark and too pink; the male upperside in nature does not show the light streaks along the veins and subterminally on the fore wing; the female has the blue lighter on the upperside and the white of both upper and undersides should be much less pure.

With this genus ends, for the purpose of these papers, the subfamily of the *Lycœninœ* characterized by normal legs, veins 5 and 6 of fore wing being distant at bases, vein 7 terminating at or before apex on costal margin (differentiating it from *Curetinœ* and *Liphyrinœ*, subfamilies which each contain only one genus, the former with two species, the latter with only one) and by having the outline of the wings quite entire with, at the outside, only a single, thread-like tail at the extremity of vein 2 of the hind wing; this last character separating it off from the subfamily *Theclinœ* which all have a rounded lobe at anal angle as well as a tail, often also extra tails at veins 1 and 3. The subfamily *Arhopalinœ* can at once be separated by having veins 5, 6 of the fore wing close together at their bases; an easy matter to settle with an ordinary lens and a little benzine.

17. Genus—CURETIS.

This is a single genus in the subfamily *Curetinœ* and consists of two species *thetis* and *bulis* recognised by Hewitson, de Nicèville and Bingham though de Nicèville enumerates no less than 7 varieties of the former species described by different authors and Bingham, 4; and 6 and 7 respectively of *bulis*. The butterflies are powerful fliers, quick and strong on the wing, are of large size varying from 1·6 to 2 inches in expanse, the males a rich coppery red on the upperside with a broad or fine black border, the females white or ochreous with black borders that, in certain cases, completely obliterate the discal, light patches; the undersides of both are white, more or less pure and glossy in *thetis*, silvery-white or silvery-greyish in *bulis* with transverse markings and dots or specks of blackish; the outline of the wings of *thetis* is even and constant, whereas, in the other species, the outline is extremely inconstant running to a falcate apex in the fore wing and production of the anal angle and outer margin in the hind wing. The distribution of the various forms gives no clue to their claim to be treated as distinct species. De Nicèville says he knows no character by which the variable females of *thetis* can be paired with the more constant males. The larva is most abnormal both in shape and in the possession of permanently exerted tubes of considerable length to the organs on segment 12. The pupa is also exceptional being nearly semispherical in shape. The geographical range of the genus is confined to the Indo-Malayan Region.

162. Curetis thetis, Drury.—Male (Pl. H., fig. 56)—*Upperside*: no hairs on the disc ; dark cupreous red, glossy and shining. Fore wing : no fringe of hairs on the inner margin after base ; base irrorated with dusky scales ; costa edged with a narrow, inwardly jagged, jet-black band that broadens to the apex, thence continued along the termen, decreasing in width to the tornus ; opposite the apex the inner edge of the black is more or less acutely angulate. Hind wing : base and dorsum broadly but slightly irrorated with dusky scales ; costa narrowly, dorsal margin more broadly pale ; termen very narrowly and evenly margined with black. *Underside* : shining silvery-white. Fore and hind wings crossed transversely by discal and inner subterminal, somewhat lunular dark lines and a more or less obsolescent outer subterminal line of minute dark dots. These markings generally very indistinct but traceable ; in some specimens more clearly defined but never prominent. Antennæ (club not flattened, it and shaft orange red inside), head, thorax and abdomen dusky black; in some specimens the head, the thorax laterally and the base of the abdomen brownish mouse-colour ; beneath : the palpi, thorax and the basal half of the abdomen medially silvery-white, (the palpi and legs often touched with copper-red,) the sides and apex of the abdomen dusky black. Female.—(Pl. H., fig 56a). *Upperside* : fore wing ; dark brownish-black ; a large medial patch that extends from vein 1 to vein 4, enters the lower half of the cell and extends from base outwards for about two-thirds the length of the wing, white ; at the base of the wing this patch is shaded and obscured for a short distance by dusky grey or black. Hind wing : pale dusky black ; a darker, short, broad, brownish-black streak from base along the subcostal vein, that outwardly broadens into an irregularly round patch beyond which is a broad, short, upper discal, white band with ill-defined and somewhat diffuse margins. *Cilia*, fore and hind wings : light-brown or white. *Underside* : as in the male but the markings still more indistinct. Palpi much longer in the female than in the male, legs of both sexes thick, tarsi broadened at extremities. Expanse : Male and female, 41-45 mm.

Egg.—The egg is more or less hemisperical in *shape*. The *surface* is moderately shining and covered with large, coarse-walled, deep cells though the walls are not actually very thick ; there are very slight thickenings at each wall-intersection though these are not always prominent. The largest cells are hexagonal, more or less regular and are situated about the middle of the perpendicular sides, the size decreasing very little upwards, until they get close to the deep, rather conspicuous, concave-bottomed, perpendicular-sided, central micropyle-cell which is about 0·1 mm. in diameter ; this micropyle is surrounded by seven irregular, badly-formed, small cells and this row again by 9 much larger ones (0·15 mm.), the next row being larger still ; there are 7 rows from top to bottom, not counting the very small ones round the micropyle and the lowest row of all are also rather small ; there are 16 cells round the broadest part ; each of these are about four wall-diameters in width ; the bottoms of all are finely chagreened. *Colour* is light green with the walls enamel-white. B : 1·15 mm. ; H : 0·72 mm. B of smallest cell : 0·05 mm.

Larva (Pl. II., fig. 28).—Is quite abnormal in *shape* being longly oval seen from above, the anal end somewhat narrower than the fore-end generally except that, occasionally, the larva shrinks the portion about segment 9 into more or less of a waist ; the head is hidden under segment 2 which is more or less a short parabola in outline (a quarter-sphere in shape) seen from above, with a largely tumid flange all round which is triangularly emarginate in the dorsal line, the slope of the dorsal line being at first nearly perpendicular to the longitudinal axis or plane of the ventrum, this ventrum being quite flat and applied to the surface upon which the larva rests ; this slope diverges little from the perpendicular throughout its length ; segment 3 is rather flat dorsally but very steep on the sides and passes evenly all round into segment 4 which is broader and higher all round with a transverse tumidity (or ridge) along the hinder margin, this tumidity being largely notched or indented in the dorsal line ; segment 5 is similar to segment 4 but the tumidity along hinder margin, more widely notched and more pronounced, if lower than that of that segment—segment 4 is the highest part of the pupa and the tumidity (or ridge) does not extend so far down the sides of the larva on segment 4 as on segment 5 ; the anterior margin of segment 6 is perpendicularly below the top of the tumidity of segment 5 ; the succeeding segments 7-11 are more or less normal, all telescoped into each other, the transverse section of the larva along that portion being semicircular ; segment 12 is slightly broader than segment 11 (very little, however, often not visibly) but is dorsally much higher owing to there being a pair of long, fleshy, stiff, cylindrical tubes or towers, standing out more or less perpendicularly from the surface, rising from shortly conicals broad bases, these towers as long as the larva is high at that place emitting, when the larva is teased, each from its top, a long brush of fine, purple, white-tipped hairs or threads which is whirled round rapidly for a short time and then suddenly withdrawn ; segments 13 and 14 behind are a more or less quarter-spherical piece though dorsally slightly flattened perhaps; the gland on segment 11 is not present but there is a transverse depression ; there is no dorsal depression on segment 2. On the whole the larva is broadest and highest at segment 5 from where the dorsal line descends in a gentle curve to rise again to segment 12 a little ; the lateral line is straight. The *head* is hidden under segment 2 and rarely protruded ; it is shining light yellow in colour with the eye curve and points of the mandibles black, the labrum light, the ligula brown, shallowly emarginate. The *spiracles* are of ordinary size, oval in shape and nearly white or brownish-white in colour. The *surface* of the larva is covered with a shagreening of minute, water-bubble-like ribbed blisters from each of which rises a minute, appressed, often flattened, hair ; a few, dispersed, longer, appressed, yellow hairs here and there on each segment and there are some much longer, simple, appressed hairs disposed along margin of segment 2 and hinder margin of segment 14 (though these hairs are still very short) ; in the place where the depression on segment 2 is situated in the majority of lycænid larvæ the surface is here also covered with minute, ribbed, hemispherical tubercles like the rest. The *colour* of the body is dark-green or rose-green; the top of segment 3 is pale rose, bordered with white posteriorly along the hinder margin, the lateral border being more or less diagonally down from the dorsolateral region on each side, running backwards ; segment 4 similar, the white hinder margin continued down to the dorsoventral margin ; segment 5 is also rose-coloured on the back slope of the tumidity but is otherwise dark-green, paling backwards ; the rest of the segments similar ; all the segments are lighter on dorsum separated from the darker, lateral colouring by a short, still lighter—nearly white in some specimens—line or band which only reaches the lateral region except on segment 9 where it is very much broader and produced down to the spiracle and above it on to the next segment on each side ; there is a dorsal, interrupted line of dark-green sometimes : segment 2 is rose-coloured and there is a light subspiracular band or line ; the towers are rose and dark-tipped and their surfaces are slightly rough. L.: 17mm.; B: 5·5mm.; H: 5 mm.; L of towers: 3mm.

Pupa. (Pl. II., fig. 28a)—The *shape* of the pupa is also abnormal (Pl. II., fig. 28a). It is semi-ellipsoid cut through the longitudinal axis, somewhat abnormally broadened behind and narrowed in front; the *head* is altogether ventral; the body is highest at the thorax and of the same height as far as the common margin of segments 6, 7; broadest at the common margin of segments 7, 8; the ventrum being absolutely one plane, quite flat and closely applied to the resting-surface; there is no constriction behind thorax either laterally or dorsally; the front margin of pupa is semi-circularly rounded; the anal extremity is hoof-shaped and narrowed and there is slight lateral constriction just before it, the dorsal slope of the front of the pupa is perpendicular to the longitudinal axis of the body as well as the edges of the pupa all round as far down as segment 10; the dorsal line of the anal segments are inclined to the resting surface at a considerable angle. The *spiracles* of segment 2 are linear and white; the rest are narrowly oval and of ordinary size. The *surface* is minutely punctured, shining, covered with a sparse clothing of short, erect, white hairs on the front of the eyes; a rugose, yellow, spade-shaped surface with its apex directed forwards on dorsum of the posterior slope of thorax. *Colour* green or rose with a subdorsal and lateral, obsolescent, darker band and the spade-shaped, large and conspicuous, yellow mark on dorsum of the hinder slope of thorax. L. 10mm.; B: 7mm.; H: 5mm.

Habits.—The egg is laid on flowers or young leaves upon which the larva always feeds; it rests, in its earlier stages, always on the undersides of leaves but, when full-grown, it is often found on the uppersides. It is never attended by ants. The eggs take three days to hatch. The little larva eats its way out through the top and sometimes eats the shell as a first meal; it then eats the young leaf in holes and is, in its first stage, without any sign of the towers on segment 12; these appear in the second stage. It starts eating from the edge of the leaf from the third stage. It grows rapidly, taking only ten days from the time it comes out of the egg until it changes to a pupa; the butterfly appears in about four days after pupation. The pupa is formed on the upperside of a leaf as a rule and is attached strongly by the tail and a tight body-band. It makes a quick, knocking noise when touched by moving up and down in a very small angle from the tail. The butterfly is a strong and powerful flier, the male being found basking on tree-tops and elsewhere on the uppersides of leaves in the sun, the wings slightly separated from each other; it darts at any passing object and, pursuing it a short way, returns often to the same perch, or flies about backwards and forwards seemingly just for a little exercise before doing so. When at absolute rest it sits on the undersides of leaves with the wings closed and only the white undersides showing. The female is more often met with amongst the undergrowth near the ground but also flies high at times. She also basks for short periods like the male but lower down as a rule and is not often seen on hill-tops and high trees. They both like the sun but do not seem to come much to flowers;

they may be seen, however, sucking up moisture from damp places in the hot weather. The foodplants of the larva are *Pongamia glabra*, the Indian Beech; *Derris scandens; Xylia dolabriformis*; *Abrus precatorius*; and various other leguminous plants; also, according to de Nicèville, *Heynea trijuga* of the *Meliaceæ*. The range of *Curetis thetis* is: the whole of India; Ceylon; the Andamans and Nicobars; Assam; Burma to Sumatra and Java.

Plate H, figures 56 and 56a are good pictures of male and female *Curetis thetis*.

163. Curetis bulis, Doubleday and Hewitson.—Male.—*Upperside*: fore wing: velvety-black, an elongate, broad, medial, patch dark orange-red, that extends from base outwards for about three-fourths the length of the wing and fills the area from vein 1 to the middle of the cell; in some specimens diffusely spread below vein 1 near base, but there shaded with dusky black; the outer margin of this red patch unevenly rounded. Hind wing: brownish-black, a large orange-red spot above vein 3 to near apex, inwardly extended into the cell to near the base of the wing and posteriorly diffuse below vein 3, but in the cell thickly overlaid with dusky-black scaling and posteriorly shaded with long brown hairs that in certain lights take a golden tint; above the cell extended from the base of the wing to the inner margin of the orange spot is a prominent broad streak of a shade darker than the ground-colour; abdominal fold pale pinkish-brown. *Underside*: silvery-white with sparsely scattered minute black dots. Fore wing: a discal and inner subterminal series of sometimes very indistinct, somewhat lunular, black markings that form broken, anteriorly convergent bands, which are continued over the hind wing to the tornus; beyond these, on both fore and hind wings, succeeds an outer, subterminal series of minute black dots, in most specimens very indistinct. Antennæ, head, thorax and abdomen dark brown; sides of the abdomen golden brown; beneath: palpi (third joint only, the tip of second joint black), thorax and abdomen white. Female. *Upperside:* more or less as in the male, but the dark orange-red medial patches replaced by white and much larger. On the fore wing this white patch extends above the cell, the discocellulars closing which are prominently marked by a black tooth, and posteriorly it reaches the dorsal margin. On the hind wing the white patch is very large and in some specimens very diffuse. Both fore and hind wings are shaded at the base by dusky scales and in many specimens the markings of the underside are plainly visible by transparency; the broad, black streak above the cell on the hind wing is present in some, absent in other specimens. *Underside:* ground-colour and markings as in the male, but much more prominent. Expanse: Male and female, 46-50 mm.

Larva and pupa.—The species has been bred in Kanara in the year 1894 on the flowers of *Ougeinia dalbergioides*, Benth., known to commerce as Chittagong Wood, a moderate sized or large tree which bursts out into profuse pinkish-white blossom, before the appearance of the leaves, in the hot weather. The caterpillars and pupæ did not differ much from those of *Curetis thetis* as far as memory serves, but it was before the days when the writer was much interested in the subject. The specimens of the butterflies are, however, still quite perfect and are the only ones that have ever been seen in Kanara.

Habitat.—Himalayas from Kumaon to Bhutan; Central India; Pachmari; Southern India: the Wynaad, Kanara; Assam; Sylhet; Upper Burma; Maymyo, 3000′.

This accounts for the subfamily *Curetinæ*, distinguished at once from *Liphyrinæ* (which does not concern us here) by the smaller size of the insects and the coloration; from *Arhopalinæ* and *Poritiinæ* (which also does not concern us) by having veins 5, 6 of fore wing rather far apart at their bases besides by their general coloration and facies; from *Lycæninæ* and *Theclinæ* by vein 7 of fore wing terminating after the apex on the terminal or outer margin (in those two subfamilies it terminates at or before the apex on the *costal* margin). However, even without reference to veins, the two forms of *Curetis* once seen can never be confused with anything else as they have characteristic colouring both above and below. The larval stage is also thoroughly characteristic for there is no other lycænid insect with a similar caterpillar recognizable at the first glance by the greatly prolonged cylinders to the organs of segment 12. The hemispherical pupa is also not to be mistaken.

(*To be continued.*)

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INDIAN DRAGONFLIES.

BY

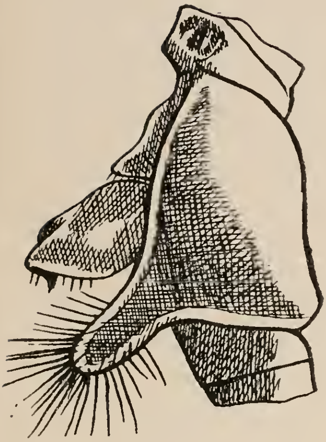
Major F. C. Fraser, I.M.S.

(*With* 12 *Text-figures*).

(*Continued from page* 627 *of Volume* XXV).

Part III.

Genus—Lyriothemis.



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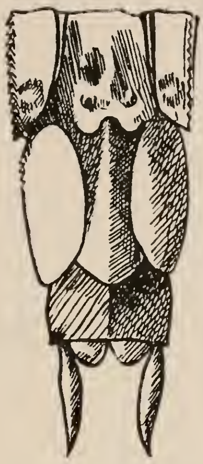

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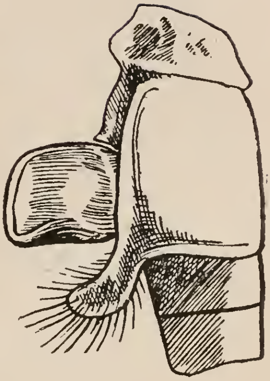

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Fig. 14.—Male sexual organs of *L. acigastra* (× 12).
,, 15.—Female sexual organs of *L. cleis* (× 12).
,, 16.—Male sexual organs of *L. cleis* (× 12).

Lyriothemis, Brauer (1868).

Calothemis, Selys.

Head large; eyes moderately contiguous; forehead narrow, somewhat rounded, prominent and in the male of one species, with a sharp anterior foreborder; sutures moderately deep; vesicle notched.

Prothorax: posterior lobe small, arched, not projecting.

Thorax robust.

Legs robust, armature in the two sexes almost identical, that of the hind femoræ, a row of gradually lengthening and moderately small spines; tibial spines numerous, fine and moderately long. Claw-hooks ordinary. Abdomen short and depressed; in the male somewhat dilated at the base and then gradually tapering to a point at the anal end; in the female cylindrical and with the lateral borders nearly parallel.

Sexual organs of the male: tentaculae large and markedly differentiated, the internal segment indented. Superior anal appendages small.

Sexual organs of the female: border of 8th abdominal segment much or only slightly dilated according to species; vulvar scale very small and made up of two opposing valves.

Wings long and narrow or moderately narrow, hyaline or with but a poorly marked spot at the base; reticulation close; trigone of forewing in line with that of the hind; sectors of arc fused for a short distance in the forewing, for a somewhat longer distance in the hind; arc usually lying between the 2nd and 3rd antenodal nervures or occasionally between the 2nd and 3rd (this point very variable); 8th nervure in the hindwing springing from the anal angle of trigone; antenodal nervures 9-18, the final complete; base of trigone in the hindwing generally at the arc or it may be a little distal or proximal; 1-5 cubital nervures in the forewing, 2 or more in the hind; supernumerary nervures to the Bridge very often present (this point very variable); trigone in the forewing very broad, traversed; sub-trigone in the forewing with 2-5 cells (usually 3); trigone in the hindwing traversed, seldom entire; the distal side straight or bent; 4th nervure slightly convex or with a distinct costal bay; the end bent strongly or slightly basalwards at the termen: generally 1 row of cells between 5 and 5 *a*; discoidal field in forewing beginning with 2 to 3 rows of cells and then gradually or markedly dilating towards the termen; 8th nervure moderately or strongly curved: generally 2 rows of cells in the anal field of forewing, moderately developed in the hind; loop markedly variable and presenting all grades of development from a small obtuse angle to a completely developed apical segment.

Stigma medium. Membrane small.

KEY TO SPECIES.

Wings relatively short and rounded.
  Antenodal nervures numbering 9-10.
  Distal side of trigone in hindwing moderately bent.
  Only 1 cubital nervure in the forewing.
  Arc usually between the 2nd and 3rd antenodal nervures and never distal to the 2nd.
  4th and 5th nervures bent very slightly at the termen.
  Apex of loop relatively short .. .. *L. acigastra.*
Wings relatively long.
  Antenodal nervures 13-19.
  Distal side of trigone in forewing strongly bent.
  2 to 3 cubital nervures in forewing.
  Arc generally between the 2nd and 3rd antenodal nervures and never distal to the 2nd.
  4th and 5th nervures bent very strongly at the termen.
  Apical segment of the loop well-developed and a large outer angle present .. .. *L. cleis.*

7. Lyriothemis acigastra, Brauer.
Calothemis acigastra, Selys.

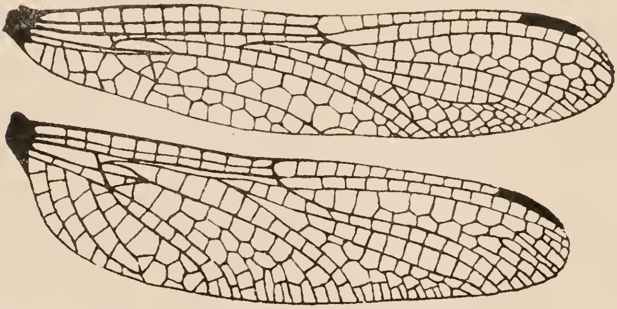


Fig. 17.—Wings of *L. acigastra* (×2).

Expanse 52 mm. Length 30 mm. Stigma 2 mm.

Head: labium bright yellow; the middle lobe dark brown; labrum and face bright yellow; vesicle and forehead a glossy metallic blue.

Prothorax black.

Thorax black with bright yellow markings as follows:—A broad humeral stripe ending about half-way as traced upward, a tiny, inconspicuous spot in line with and above the latter, laterally a broad, somewhat sinuous stripe crossing the thoracic spiracle, separated from the humeral stripe by somewhat less than its own breadth, a second stripe posterior to the spiracle on the lower two-thirds of the side, a spot above it and the greater part of the metepimeren yellow. Underside of the thorax deep black, crossed by two small transverse, yellow stripes. Abdomen generally deep black; segments 2 to 5 frosted thickly with white and so appearing blue. Deep black below, powdered with yellow; a yellow spot on both sides of segment 1, the distal border of segment 2 striped narrowly with yellow; the distal borders of segment 3 to 7 similar but the stripe rather broader.

Legs black, with the inner sides of the anterior femoræ yellow.

Base of wings yellow, this colour becoming paler and more diffuse as traced towards the trigone.

Secondary sexual organs of the male: tentaculæ shaped like an oval leaf, outwardly black, yellow in front, behind and on the inner side; the inner angle prolonged backward as small hooks; lobe narrow and about two-thirds the height of tentaculæ.

Neuration of the wings very variable.

Type:—Arc $\frac{2\text{-}3,\ 2\text{-}3}{2\text{-}3,\ 2\text{-}3}$; Cubital nervures $\frac{1}{2\cdot 2}$; No supernumerary nervures to Bridge; Hypertrigones traversed $\frac{1\text{-}0}{0\text{-}0}$.

Female: unknown.

Hab. Burma and Bengal.

8. Lyriothemis cleis, Brauer.

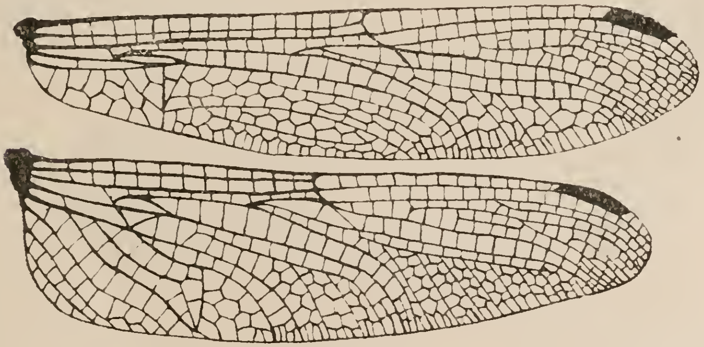


Fig. 18.—Wings of *L. cleis* (× 2).

Expanse 78 mm. Length 42 mm. Stigma 2 mm.

Thorax dark brown or black marked with yellow.

Abdomen partly or wholly red.

Wings: base always hyaline, the apex smoky or greyish brown, and in some species the whole wing smoky. The neuration more constant than in *acigastra*; the discoidal field of forewing strongly dilated at the termen; arc situated at the 2nd antenodal nervure or beyond it, and occasionally as far distal as the third; 8th nervure strongly convex; 4th and 5th nervure strongly bent towards the termen. In the males, generally only 1 row of cells between 5 and *5a*; in the females a row of double cells.

Size very variable and the wings often showing asymmetry.

Genital organs of the male: the lamina lying very low, the tentaculæ very large and prominent, shaped as an arched cone, with a somewhat sinuous surface, generally meeting at, or actually crossing each other in the middle line; the lobe long and narrow, right-angled, a little dilated at the end and cut straight away below, coated with long, stiff hairs, and rather more than half the height of the tentaculæ.

Female genital organs: lateral borders of the 8th abdominal segment not dilated; the 8th ventral plate separated from the vulvar scale by a narrow margin; the vulvar scale very small and bisected by a triangular notch nearly up to its base; 9th ventral plate prominently keeled and not prolonged posteriorly.

Hab. Burma.

Ris mentions a male specimen in the British Museum from Col. Bingham, Burma, which he places provisionally as "*cleis*." Its body is frosted white; there is only 1 cubital nervure to the forewing; 3 cubital nervures in the hind; the wings relatively narrower than in other specimens of *cleis*, but the discoidal field shaped as in this species; bright yellow, basal rays to both wings; a flattened hook on the inner border of the tentaculæ.

Abdomen 32 mm. Hindwing 38 mm. Stigma 2 mm.

Hab. Bhamo.

Genus—POTOMARCHA.

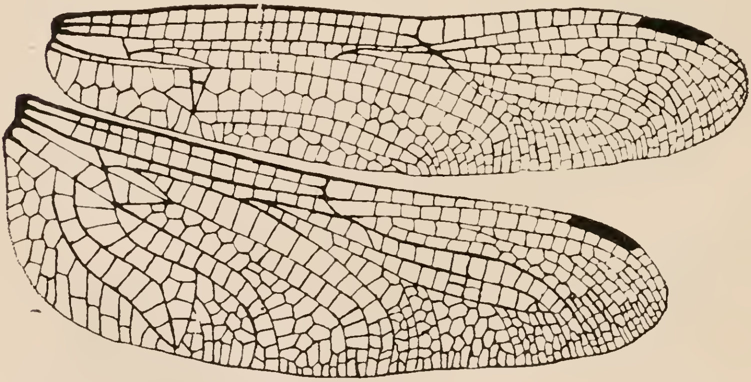


Fig. 19.—Wings of *Potomarcha* (×2).

Potomarcha, Karsch.
Libellula, Rambur.
Orthetrum, Kirby and Brauer.

Head moderately large; eyes broadly contiguous, for about as long an extent as the breadth of the occipital triangle: forehead flatly arched and without a distinct foreborder, suture moderately deep; vesicle high, narrow and notched.

Prothorax lobe very small, spherical, slightly convex, not projecting.

Thorax robust.

Legs moderately short; hind femoræ with a few widely distant, gradually lengthening spines; tibial spines moderately numerous, short and slim; claw-hooks ordinary.

Genital organs.: (*see* species).

Wings long and moderately narrow; reticulation close; trigone in the forewing a little distal to the trigone in the hind; sectors of the arc in forewing short, in the hind moderately long; site of arc a little variable, generally between the 2nd and 3rd antenodal nervures, often at the 2nd, rarely between the 1st and 2nd; 8th nervure in the hindwing at the trigonal angle; antenodal nervures $11\frac{1}{2}$ to $16\frac{1}{2}$ (in seven consecutive specimens examined, these numbered $11\frac{1}{2}$, $12\frac{1}{2}$, $13\frac{1}{2}$, $11\frac{1}{2}$, $15\frac{1}{2}$, 14 and $14\frac{1}{2}$.); base of trigone in the hindwing at the arc; the outer side of the latter trigone concave; 1 cubital nervure to all wings; no supernumerary nervures to the Bridge; trigone in the forewing moderately narrow, at a little more than a right angle in relation to the hypertrigone; all trigones traversed; all hypertrigones entire; 4th nervure with a strong double curve at its middle; the discoidal field with nearly parallel borders, but slightly dilated at the termen, with 3 rows of cells; 2 rows of cells between 5 and *5a*; anal field in forewing with 2 to 3 rows of cells, in the hind, wide and with a well-developed loop, the outer angle of which is nearly right-angled and extends about 2 cells breadth distal to the apex of the trigone.

Stigma large and narrow. Membrane large white or greyish.

9. **Potamarcha obscura,** Karsch.

Libellula obscura, Rambur.
Orthetrum obscura, Kirby.
Libellula congener, Rambur.
Orthetrum congener, Brauer.
Potamarcha congener, Selys.

Expanse 68 mm. Length 45 mm.

Head: eyes brown above, laterally and beneath a slatey, opalescent blue; occiput small, dark brown; vesicle dark brown; front, epistome and labrum a dirty, creamy white; labium yellow.

Protorax: black; in the male heavily frosted with white and so appearing blue; in the female a dark brown, with a mid-dorsal, bright yellow stripe, bisected with a fine black line.

Thorax; male black heavily frosted over with white and so appearing blue. The colouring varying greatly according to the age of specimens and also according to the season in which they are taken. Juvenile specimens and wet season forms bear, to a greater or lesser extent, the yellow markings of the female described below. A complete series may be taken showing from an intense white frosting with no markings, up to others which have little or no white powdering and approach the females in the richness of their colouring. Female: a deep chestnut brown or black with no white frosting and marked with yellow or greenish-yellow as follows:—the mid-dorsal line on the prothorax continued on to the thorax as far as the tergum, the fine black line bisecting it as on the prothorax, laterally the whole of the side bright yellow, with three, oblique, narrow, black streaks traversing it, the anterior and posterior of which are bisected above to form two large, Y-shaped marks.

Wings hyaline, the apices slightly tinted with brown, in the male; the area between the node and the stigma is occasionally faintly smoky; in the female, the area from base to stigma, anterior to the 3rd nervure is, especially in the wet season forms, more or less suffused with amber tinting.

Abdomen: ventro-dorsally dilated at the base; the sides parallel as far as the 8th segment from where it tapers to a point at the anal end, a little depressed at the 2nd to 7th segment, but the last four segments slightly dorso-ventrally dilated. The abdomen of the female is considerably bulkier than that of the male which is comparatively slim. The border of the 8th segment in the female is very broadly dilated, the expanded margins hanging down and serving as claspers for the exuded eggs when ovipositing. Colour in the male exceedingly variable according to the same factors which affect the colouring of the thorax. A complete series may be taken ranging from an uniform bluish frosting over black and with no markings, to specimens which closely approach the females in the richness of their colouring. Generally, however, the first three segments are frosted over, the colours beginning to show through the frosting on the third segment. In the female the intersegmental nodes are broadly and diffusely black; a fine mid-dorsal black line runs from the 1st to the 8th segment, bordered outwardly by a pale greenish-yellow line. This latter is again bordered outwardly by black. The borders of the abdomen as far as the 8th segment broadly and richly coloured with golden yellow or ochreous. Beneath dark ochreous. Anal appendages long, as long as the 9th abdominal segment, cylindrical, narrow, sinuous, sloping ventralwards at the ends, which are pointed. The inferior nearly as long as the superior and sloping up to meet the latter, dark brown or black; those of the female widely remote, much shorter than those of the male and shorter than the 9th abdominal segment, cylindrical, pointed, black.

Sexual organs of the male: tentacula small, regular in shape; the lamina broad, flattened, the lower border projecting somewhat, furnished with numerous black spines. Outer tentacula extending widely posteriorwards, long and oval; the inner a small, stout, curving hook. The lobe small and a little arched.

Sexual organs of the female; border of the 8th abdominal segment strongly dilated; a small, inconspicuous vulvar scale at the end of the 8th ventral plate; 9th ventral plate flattened and not distinctly carinated, ciliated.

Hab. India generally, Burma, Ceylon, Straits, and Sylhet.

This dragonfly has a common habit of perching on prominent pieces of twig or on the twigs of bare trees. Numbers may often be seen occupying the branches of one tree, especially just before sun-down. The males may often be seen resting on the concrete sides of *mali's* tanks in compounds.

Genus—LATHRECISTA.

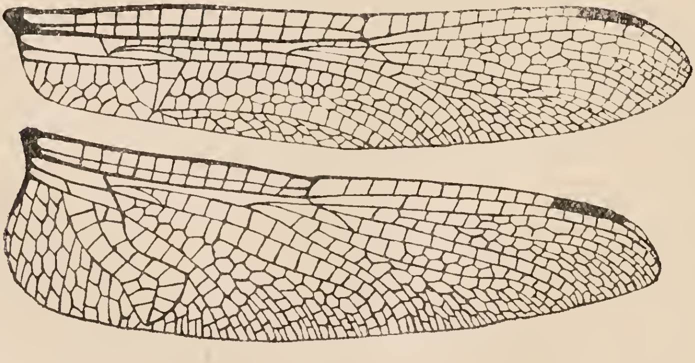


Fig. 20.—Wings of *Lathrecista asiatica* (× 2).

Lathrecista, Kirby.
Libellula, Fabricius.
Orthetrum, Kirby.
Libellula, Brauer.
Agrionoptera, Selys.

Head relatively large, globular; eyes broadly contiguous: forehead projecting; anterior border in the male poorly marked, rounded in the female: sutures flush; vesicle notched or bearing two small tubercles at its summit; a ruff formed of small tufts of short hairs lining the upper margin of the occipital cavity and overhanging and partially concealing the prothorax.

Prothorax small; the lobe rounded, not projecting, naked.

Thorax robust, coated with hair in front on the dorsum, naked at the sides.

Legs; hind femoræ of the male bearing about 16 short, broad, uniform spines; tibial spines long; claw-hooks ordinary. Hind femoræ of the female with somewhat longer spines and less numerous than in the male. Wing long and narrow; reticulation close; node in the forewing relatively near the base, a little proximal to the middle of the wing; trigone in the forewing in line with that of the hind; sectors of arc in forewing rather shortly fused, in the hind a much longer fusion; arc between the 2nd and 3rd antenodal nervures; 8th nervure in the hindwing at the anal angle of the trigone; $13\frac{1}{2}$ to $17\frac{1}{2}$ antenodal nervures; trigone in the hindwing at the arc or occasionally a little distal to it; trigone in the forewing at more than a right angle in relation to the hypertrigone, traversed, that of the hind entire; all hypertrigones entire; sub-trigone of the forewing formed of 3 cells or more rarely of 4; only 1 cubital nervure to all wings and no supplementary nervures to the Bridge; 4th nervure distinctly double-curved; 1 row of cells between 5 and 5*a*, occasionally a few doubled cells; 3 rows of cells in the discoidal field; the latter only a little dilated at the termen; 8th nervure flatly convex; anal field in forewing with 2 rows of cells, in the hind moderately broad; loop long, the apex very stunted, split cells at the outer angle only: the outer angle nearly equal to a right angle, extending 2 to 3 cells beyond the apex of trigone.

Stigma large. Membrane small.

Abdomen: slim, keeled, triangular in cross section, parallel-sided or in the male, segments 3 to 5 a little constricted.

Anal appendages cylindrical, a little bulbous near the extremities which are pointed and curving, black. The inferior appendage curving up to meet the superior The superior are rather longer than the 9th abdominal segment. Those of the female very small, widely remote, cylindrical, black.

Sexual organs: (*See* under species).

10. Lathrecista asiatica asiatica, Ris.

Lathrecista pectoralis, Kirby.
Libellula asiatica, Fabricius.
Orthetrum asiatica, Kirby.
Libellula pectoralis, Brauer.
Agrionoptera simularis, Selys.
Lathrecista simularis, Selys.
Lathrecista terminalis, Kirby.
Lathrecista pectoralis, var. *interposita*, Förster.

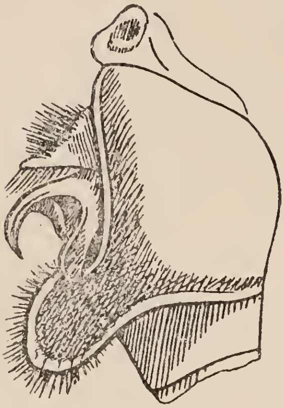


Fig. 21

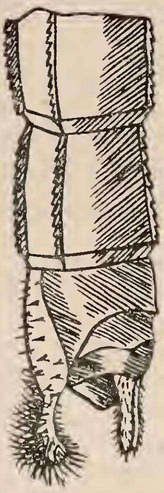


Fig. 22

Fig. 21.—Male sexual organs of *Lathrecista asiatica* (× 12).
Fig. 22.—Female sexual organs of same (× 12).

Expanse 72 mm. Length 45 mm.

Head: eyes brown at the summit, a milky or opalescent blue laterally and beneath; occiput black; vesicle blackish brown; labium, labrum, clypeus and lower part of epistome opaque white, the epistome above and narrowly at the sides glossy black brown.

Prothorax: a violet brown.

Thorax: a violet or purple brown frosted over with white.

Legs black; the inner sides of the anterior femoræ paler.

Wings hyaline; the extreme outer edge of the apices touched with brown. Stigma dark brown. Membrane brownish or brownish white.

Abdomen polychroic; the first 3 segments reddish brown and often frosted over with white which gives a bluish tinge to them, the remaining segments a bright carmine red with very narrow, black annuli at the intersegmental nodes. Some specimens have a greenish-yellow, narrow, mid-dorsal stripe on the first 3 segments. Other specimens instead of carmine red, are a rich, dark olivaceous brown.

Female: eyes violet brown or purple coloured above and greenish yellow at the sides, paling considerably beneath; mid-lobe of labium black, lateral lobes bright yellow; vesicle metallic blue with a small white spot on either side of the mid-ocellus; upper part of front a dark olivaceous tint with a metallic green sheen, the lower part pale greenish yellow narrowly bordered with black.

Thorax: a mid-dorsal greenish-yellow stripe bisected by a narrow black line; broad, purple-brown, humeral stripes with a metallic sheen; laterally greenish-yellow with 3 very irregular, oblique, dark, metallic green stripes, the anterior of which is bifid in its upper part, the middle one crossing the spiracle; the posterior also bifid in its upper part. All these markings liable to a certain amount of variation. Beneath, the posterior stripe is continuous with a black square, the centre of which is greenish-yellow.

A row of greenish-yellow spots on the tergum, an anterior pair followed by 3 in line from, before back.

Abdomen : a rich warm brown with a fine mid-dorsal, black line edged narrowly on either side by bright greenish-yellow, broadest on the 1st and 2nd segments. This yellow again outwardly edged by a diffuse, black line. The lateral borders edged very narrowly with black, with, in the 1st and 2nd segments a greenish-yellow stripe. The final 3 segments almost entirely black.

In juvenile specimens of the male and in a brood appearing towards the end of the S.W. monsoon in Malabar and the Western Ghats, the markings are almost the same in the two sexes. The thorax markings in the male are in old and dry season forms almost or entirely obsolete and all grades are met with from the latter up to specimens as richly marked and coloured as the females.

Genital organs of the male ; lamina projecting and rather broadly arched, furnished with stout vibrissæ on its inner surface ; tentaculæ large, the external segment projecting outwards over the lobe, the inner segment bearing a long chitinous hook; lobe smaller than usual, not as tall as the tentaculæ, lined internally with stiff vibrissæ.

Genital organs of the female : specific in character; vulvar scale small, lateral borders of the 8th abdominal segment not dilated, 9th ventral plate prolonged back beyond the anal end of the abdomen and ending in two curling laminæ which are thickly beset with short, stiff bristles. This projecting organ is easily visible to the naked eye and sufficiently specific in character as to determine the species from any other.

Hab. The moister areas of India generally, Bombay and Poona.

A rather shy and retiring insect, usually keeping to the shelter of thick jungle and with habits somewhat similar to *Potomarcha*, often collecting in large numbers on the bare branches of trees. I have never seen it visiting water.

Genus—LIBELLULA.

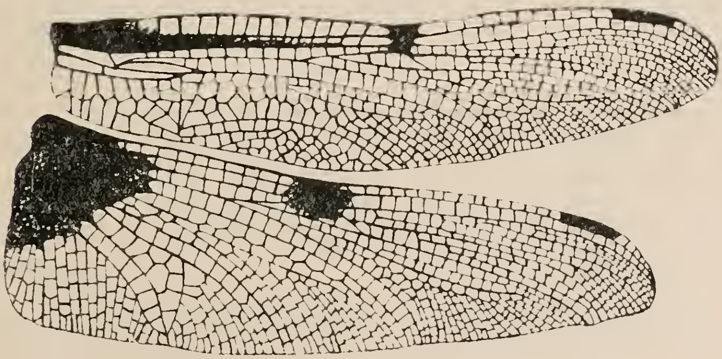


Fig. 23.—Wings of *Libellula quadrimaculata* (×2).

Libellula, Rambur.

Head moderately large ; eyes broadly contiguous ; forehead broad and projecting, but a little variable in the species, anterior border indistinct or moderately sharp ; suture deep ; vesicle a little notched or rounded.

Prothorax lobe small, slightly arched, entire or with a small notch.

Thorax very robust.

Legs robust; hind femoræ with numerous moderately close-set, very short, and near the end, gradually lengthening spines with one or two longer spines at the extreme end; femoræ 2 similar but the spines somewhat less numerous and larger; tibial spines numerous, moderately slim and long; claw-hooks large; in the female the armature almost identical.

Abdomen variable in shape, generally robust and depressed.

Sexual organs of the male: tentaculæ small with a regular and reduced outer segment.

Sexual organs of the female; border of 8th abdominal segment variable. vulvar scale small and not projecting.

Wings long and narrow, in many species partly coloured. Reticulation close; trigone in the forewing generally somewhat distal to the trigone in the hind, its relation to the hypertrigone a right angle or rather more; sectors of arc in the forewing separated or if fused, the fusion very short, in the hind a shorter fusion generally present; between the 1st and 2nd antenodal nervures, occasionally at the 2nd or between the 2nd and 3rd; 8th nervure in the hindwing from the anal angle of the trigone; antenodal nervures 12-17, the last usually complete; trigone in the hindwing long and narrow with a concave outer side, at the arc or a little distal or proximal to it; 1 cubital nervure in the forewing, 1 to 2 in the hind; supernumerary nervures to the bridge as a rule present; all trigones traversed, in the forewing generally several times; hypertrigones traversed or entire (this point very variable); sub-trigone in the forewing with 5 or more cells up to as many as 10: 4th nervure with a strong double curve, first a costalwards convexity and then a concavity, the end being slightly bent towards the termen; at least 2 to 3 rows of cells between 4 and 5, frequently 2 rows of cells for a short distance; 3 rows of cells between 5 and *5a*; 8th nervure in the forewing short and strongly bent. The discoidal field at the termen very strongly dilated, beginning with 3 to 6 rows cells; *7a* well developed: 1 to 2 rows of cells between 7 and *7a*; loop large, its outer angle a right angle or it may be obtuse and extending 2 to 3 cells beyond the outer angle of the trigone.

Membrane large. Stigma variable, moderately small or very large.

KEY TO SPECIES.

i. The whole body including the abdomen hairy.
  Abdomen in the male red or ochreous, not frosted with blue.
  A black spot in the middle of costa and often another diffuse spot near the stigma.
  A black marking at the base of the hindwing reticulated with yellow.
  Membrane white.. .. .. *L. quadrimaculata*

ii. The abdomen naked.
  Abdomen in the male dark brown, frosted over with blue.
  No black spots on the costa or near stigma.
  A rusty spot at the base of the hindwing.
  Membrane black .. .. *L. fulva.*

11. Libellula quadrimaculata, Linné.

Leptetrum quadrimaculata, Kirby.
Libellula quadripunctata, Fabricius.
Libellula maculata, Harris.

Libellula ferruginata, Cirillo.
Libellula ternaria, Say.

Expanse, male 72 mm. Length, male 40 mm.
female 66 mm. female 36 mm.

Head: eyes dark brown above, greenish laterally and beneath; epistome clypeus and labrum luteous with a black bordering to the latter and a brown streak along the ocular margin of the epistome.

Prothorax: brownish red.

Thorax: a dull red, covered with a fine yellow pile and bearing laterally two dark brown or black, converging stripes.

Legs black.

Wings hyaline. Antenodal nervures 16. A rich red, amber tinting at the base of wings, which colour in some specimens extends along the entire costal margin. In the middle of the costa, in the neighbourhood of the node a black spot varying greatly in size and intensity and often lying in a smoky area. In other specimens this spot may be absent. A large, triangular, blackish spot at the base of the hindwing, reticulated with yellow, extending from the cubitus in front, back to rather beyond the membrane, and outwards for a variable distance towards the trigone. The cubital, median and sub-costal spaces usually bright yellow. In a variety—"*praenublia*, Newman"—a brown fascia is present near the stigma, extending for a variable distance towards the termen. This species is usually larger than *quadrimaculata* and the abdomen is less pilose. In specimens from Kashmir, the nodal spot is small and the basal marking does not extend into the trigone.

Stigma black or fuscous. 3·5—4 mm.

Abdomen broad and tapering, hairy, dull red or ochreous, the segments from the distal end of the 5th, to the anal end of the abdomen, black. All segments from the 2nd to the 7th bear a yellow lunule at the sides. The abdomen of the female much broader than that of the male.

Anal appendages black.

Hab. Kashmir 7000′—8000″.

12. **Libellula fulva,** Müller.

Libellula conspurcata, Schneider.
Libellula, var. pentica, Selys.

Expanse 72 mm. Length 40 mm.

Head: eyes brown above, paler beneath; vesicle, front. epistome and labrum somewhat bluish, glossy, dark brown.

Prothorax: dark brown.

Thorax: dull olivaceous or red or nearly black and somewhat paler at the sides streaked obscurely with brown.

Legs black; the bases of the femoræ fulvous; those of the female reddish at the base.

Wings hyaline: antenodal nervures 12; the forewing with a rust coloured ray at the base; the posterior with a similar coloured, triangular spot at the base. In some species the apices of the wings are smoky and others have the wings broadly suffused with yellow. In the forewing there is usually a black ray in the cubital space and in the hindwing, one in the sub-costal space. In some species there may be yellowish rays in the superior and inferior costal spaces extending nearly as far out as the stigma.

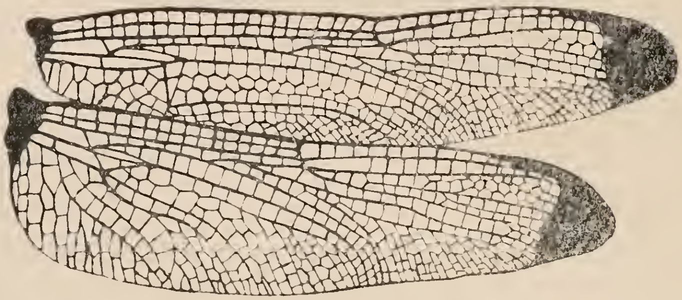
Stigma black or dark brown. 2·5—3 mm. Membrane black or dusky.

Abdomen: dark brown, with a darker brown or black, irregular, mid-dorsal stripe. The proximal and distal ends of the abdomen fuscous and the whole, especially in the males frosted with blue. In the female, yellowish brown with a well-defined, black line running from the 4th to the 10th segment, expanding at the distal border of each segment.

Anal appendages black.

Hab. Mesopotamia, Kashmir (?) and throughout Europe.

Genus—Cratilla.



24

Fig. 24.—Wing neuration of *C. metallica* (×2).

Cratilla, Kirby (1900), *Id. Ann. Mag. Nat. Hist.* 7, 5, p. 542 (1900). Forster, *Ann. Mus. Hung.*

Head large ; eyes broadly contiguous ; forehead sloping strongly in front in the male ; more rounded in the female ; suture moderately deep ; vesicle rounded.

Prothorax : lobe, rounded very small, not projecting.

Thorax very robust. Legs robust : hind femoræ with a few, thick, and gradually lengthening spines ; tibial spines fine, numerous ; claw-hooks ordinary. Armature of the legs of female scarcely different but somewhat finer and longer.

Wings long and moderately narrow ; reticulation close ; node closer to the apex than to base in forewing ; trigone in the forewing a little external to the line of trigone in the hind ; sectors of the arc in forewing moderately fused, a longer fusion in the hind ; arc between the 1st and 2nd antenodal nervures ; 8th nervure at the anal angle of the trigone in the hindwing ; 17 to 22 antenodal nervures, the last complete ; base of trigone in the hindwing at the arc or a little proximal to it ; the distal side of the trigone concave ; 1 cubital nervure to all wings ; supplementary nervures to the bridge generally present ; trigone in the forewing rather broad, its relation to the hypertrigone rather more than a right angle ; all trigones traversed ; all hypertrigones free ; sub-trigone in the forewing with 3 to 5 cells ; 4th nervure with a strong costal convexity in its middle, its end and that of the 5th bent strongly towards the termen ; 1 to 2 rows of cells between 5 and *5a* ; 3 rows of cells in the discoidal field which has nearly parallel sides but is slightly dilated at the termen ; a broad anal field in the hindwing with regular rows of cells ; loop narrow and long, extending 2 cells beyond the outer end of trigone.

Stigma large ; membrane of medium size.

The following specific characters, *viz.*, the complete, final antenodal nervure, the barely dilated discoidal field, the supplementary nervures to the bridge and the position of the node will serve to identify this genus.

KEY TO SPECIES.

i. Thorax: a deep, bronze black, its middle segment, its underside and 3 lateral bands, yellow.
Abdomen: black marked with yellow.
Labrum: yellow.
Wing apices hyaline. (Occasionally those of the female tipped with brown.)
Antenodal nervures 18. 2 rows of cells between 5 and *5a* .. .. *C. lineata.*

ii. Thorax metallic green.
Abdomen: dark metallic green without yellow markings except on segments 1 to 4 in the female. Adult males with blue frosting on the first 4 segments.
Labrum black.
Wing apices in both sexes tipped with black.
Antenodal nervures 20. 1 row of cells between 5 and *5a* .. .. *C. metallica.*

13. **Cratilla metallica,** Kirby, *Ann. Mag. Nat. Hist.* (7) 5 *p.* 542 (1900).

Orthemis metallica, Brauer (1878).
Protorthemis metallica, Kirby. *Trans. Zool. Soc. Lon.*, 12, *p.* 290 (1889). *Id. Cat.*, p. 30 (1890).
Protorthemis metallica, Selys.
Nesoxenia metallica, Kirby, *Cat. p.* 180 (1890).
Cratilla metallica, Ris. *Cat. Coll.* Selys. *fasc.* 10, *pp.* 152-153 (1909).

Expanse 74 mm. Length 36 mm.

Head large and globular; eyes broadly contiguous, dark brown above, paler below; face and labrum black; vesicle black.

Prothorax black.

Thorax: dark metallic green as far as the middle segment which is yellow.

Legs black.

Wings hyaline; the apices in both sexes, dark brown as far inwards as the middle of the stigma; supplementary nervures to the bridge always present; only 1 row of cells between 5 and *5a*; 18 to 22 antenodal nervures; stigma large, 4·5 mm.

Abdomen: a dark metallic green, without marking, in the male, and the first 4 segments in adult forms, frosted with blue. In the female, bordering lines of yellow on segments 1 to 4.

Anal appendages black.

Genital organs of the male: Lamina procumbent, broadly arched; tentaculæ short, robust, procumbent, strongly curved hooks; lobe relatively very large, broad and rounded.

Genital organs of the female; border of the 8th abdominal segment very broadly and foliately dilated; vulvar scale inconspicuous, only a slight notch on the posterior border of the 8th ventral plate; 9th ventral plate keeled, yellow, projecting slightly over the 10th segment.

Hab. Burma and Tenasserim.

14. **Cratilla lineata,** Ris. *Cat. Coll.* Selys. *fasc.* 10, *p.* 153 (1909).

Cratilla lineata, Forster, *Ann. Mus. Hung.* 1903, *p.* 537.
Cratilla calverti, Id. (*Malabar ?*).
Orthemis lineata, Brauer, Albarda and Selys.
Agrionoptera lineata, Kirby, *Cat. p.* 31 (1890).

Nesoxenia lineata, Id. *Cat. p.* 180 (1890).

Protorthemis lineata, Selys, Kruger and Martin.

Expanse 78 mm. Length 42 mm

Head large and globular; eyes broadly contiguous, brown above, paler beneath; vesicle and occiput brown; labrum yellow; frons metallic green.

Prothorax: black marked with yellow.

Thorax: a dark, bronze black; the middle segment broadly yellow, 3 lateral bands and the underside, yellow. Legs black.

Wings hyaline, the apices occasionally and in female only, a dark brown as far inwards as the middle of the stigma; 18 antenodal nervures; 2 rows of cells between 5 and *5a*; usually supplementary nervures to the bridge; stigma moderately large, 3·5 to 4 mm.

Abdomen black with a long yellow, median band which is bisected by a fine, black, mid-dorsal ridge. Lateral lunulets of the same colour to each segment.

Anal appendages black.

Genital organs of the male; lamina small, procumbent, the end tumid outwardly; tentaculæ procumbent, of nearly even length; the inner, a black, curved hook; lobe broad and rounded.

Genital organs of the female: very similar in shape to those of *C. metallica*. The carination of the 9th ventral plate somewhat sharper, bright yellow and ciliated.

Hab. Forster gives Malabar as a district in which it occurs, but it is doubtful if the insect occurs there Java, New Guinea, Sumatra and Phillipines. "Toungoo, Burma, Beeson, 1918."

Genus—ORTHETRUM.

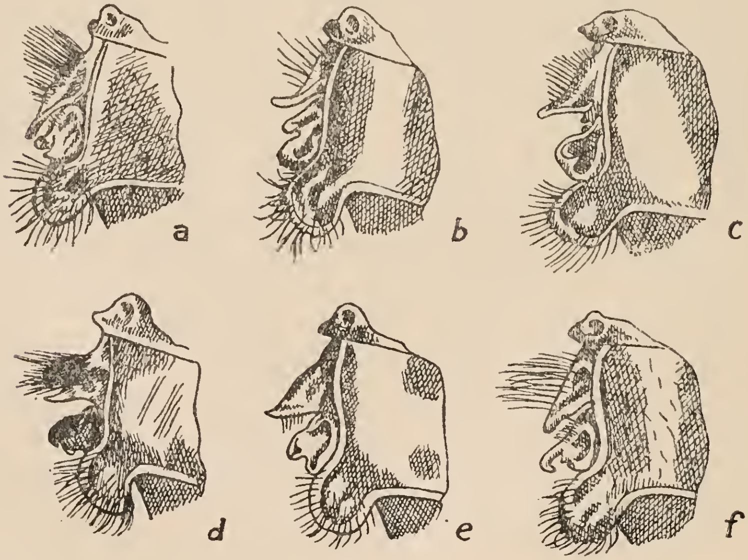


Fig. 25.—Male genital organs of—a. *O. chrysostigma*, b. *O. ransonnetti*, c. *O. japonicum*, d. *O. sabina* (×10), e. *O. anceps*, f. *O. tæniolatum*.

Orthetrum, Newman (1833).

Libella, Brauer.

Hydronympha, Buchecker.

Head moderately large ; eyes shortly or rather broadly contiguous ; forehead prominent, with a distinct foreborder, flattened, above and in front, the flattened zone very glossy, the borders rounded and the shape in both sexes nearly similar ; sutures moderately flush ; vesicle variable, either nearly rounded or somewhat notched above.

Prothorax . lobe large, projecting, fringed with a ruff of long hairs, generally notched in the middle.

Thorax robust.

Legs moderately long, very robust. Hind femoræ with a row of closely-set, numerous, moderately even, short spines and at the distal end, 2 or 3 somewhat longer ones ; mid-femoræ with fewer, gradually lengthening spines ; armature of the femoræ of the female similar to that of the mid-femoræ of the male ; tibial spines not numerous, 8 to 12 in number, stout, distant, upright or somewhat sloping ; claw-hooks close to base of claws, robust.

Wings long, the hind moderately broader than the fore ; the trigone of the forewing in line with that of the hind ; arc usually at the 2nd antenodal nervure or between the 2nd and 3rd or in one group, between the 1st and 2nd ; sectors of the arc generally with a longer fusion in the hind than in the forewing ; 8th nervure generally from the anal angle of trigone (separated in *chrysostigma* and more or less in *sabina*) ; 12 to 21 antenodal nervures (rarely more than 16 in Indian species) ; trigone in the hindwing at the arc ; 1 cubital nervure to all wings ; no supplementary nervures to the bridge ; trigone in the forewing high and narrow, its relation to the hypertrigone generally more than a right angle, its anal angle basally directed, traversed, in some species more than once ; trigone in the hindwing long and narrow ; its outer side moderately to strongly concave, entire or traversed : 4th nervure strongly undulating and the end bent strongly to the termen ; 1 to 3 rows of cells between 5 and 5*a* ; 8th nervure in the forewing short and strongly convex ; the discoidal field wide, a little constricted near its middle but strongly dilated at the termen ; 3 to 4 rows of cells in the discoidal field ; loop well-developed ; its outer angle equal to a right angle and 4 or more cells distal to the outer angle of the trigone, the apical segment longer than wide ; 3 to 6 rows of cells in the anal field of hindwing.

Stigma medium-sized ; membrane large.

Abdomen variably shaped, moderately to very strongly dilated at the base, then constricted or parallel-sided or fusiform or moderately broad and depressed and gradually tapering to the end.

Sexual organs of the male : the lamina depressed or projecting, coated with stiff hairs or naked ; the tentaculæ well-developed as a rule, the internal segment furnished with a variably sized hook ; the lobe projecting or sloping, arched more or less and generally coated with stiff bristles.

Sexual organs of the female : border of 8th abdominal segment dilated as a rule but in several species not so or only slightly so ; no distinct shape to the vulvar scale, generally notched and with a more or less swollen border to the 8th segment ; ventral plate without any specific or constant shape ; its styles distinct.

The members of this genus present such remarkable polymorphism and polychroism, not only in the species but also amongst the individuals of the species, that the task of forming any satisfactory key is one of extreme difficulty. The key given below is not entirely satisfactory but if, where difficulty is met with, it be used in conjunction with the descriptions of the species, a fairly useful index for the determination of the species will be found.

KEY TO SPECIES.

- *A.* Arc between the 1st and 2nd antenodal nervures or opposite the 2nd.
  - a. Abdomen of adult male not frosted with blue. 8th nervure from anal angle of trigone.
    - i. Abdomen broad, depressed and tapering. Base of wings hyaline .. .. .. *O. cancellatum.*
    - ii. Abdomen relatively shorter and broader. Base of wings golden yellow .. .. *O. japonicum.*
  - b. Abdomen of adult male but thinly frosted with blue, long, narrow and cylindrical. 8th nervure separated from the anal angle of trigone .. .. *O. trinacria.*
  - c. Abdomen of adult male densely frosted with blue.
    - i. Usually 2 rows of cells between 5 and 5*a*.
      - a^1. Abdomen broad and depressed. 12 to 16 antenodal nervures .. .. .. *O. brunneum.*
      - b^1. Abdomen narrow and tapering. 10 to 12 antenodal nervures. Smallest species of the genus .. .. *O. tæniolatum.*
    - ii Only 1 row of cells between 5 and 5*a*.
      - a^1 Abdomen broad and depressed. Lamina prominent, inclination to body-axis 45° to 60° .. .. *O. anceps.*
      - b^1. Abdomen narrow and parallel-sided. Lamina depressed, inclination to body-axis 30° .. .. *O. ransonnetti.*
- *B.* Arc between the 1st and 2nd antenodal nervures or occasionally opposite the 2nd.
  - a. Abdomen densely frosted with blue.
    - i 8th nervure widely separated from the anal angle of trigone in the hindwing. (Often only the first 3 segments of the abdomen frosted with blue) .. .. *O. chrysostigma.*
    - ii. 8th nervure arising from the anal angle of trigone in the hindwing.
      - i^1. Trigone in the hindwing traversed .. *O. triangulare.*
      - ii^1. Trigone in the hindwing entire .. .. *O. glaucum.*
  - b. Abdomen not frosted with blue.
    - i. Abdomen, dorso-ventrally, strongly dilated at the anal end (segments 6-9). 8th nervure separated from the anal angle of trigone in the hindwing .. .. *O. sabina.*
    - ii. Abdomen not dorso-ventrally dilated at the anal end, broad and depressed. 8th nervure arising from the anal angle of trigone in the hindwing.
      - i^1. Adult male with a yellow or red forehead.
      - a^1. Male brilliant scarlet red. Wings relatively long and with a large basal spot in the hindwing. No tuft of bristles on the lamina .. .. *O. testaceum.*

b¹. Male dull red or orange coloured.
Wings relatively short. Basal spot in the hind smaller.
A tuft of stout bristles on the lamina .. *O. chrysis.*

ii¹. Adult male with a bluish-black or violet metallic forehead.
Abdomen crimson, thinly overlaid with blue frosting which gives it a violet appearance .. .. *O. pruinosum.*

15. Orthetrum cancellatum cancellatum, Dur.
Libellula cancellata, Linne.
Libella cancellata, Brauer.
Libellula frumenti, Muller.
Hydranympha helvetica, Buchecker.
Expanse 68 mm. Length 40 mm.

Head; eyes bottle green above, paler at the sides and beneath; vesicle olivaceous brown; face and labrum cinereous; labium pale yellow.

Prothorax: brown.

Thorax: olivaceous on the dorsum, paler or greenish yellow at the sides; 2 short, black, humeral stripes and a dark greenish, oblique stripe on the side, which, latter stripe is bordered anteriorly and posteriorly with black. Beneath frosted with blue.

Legs black in the male but the femoræ in the female reddish with a black line on the outer sides.

Wings hyaline; site of arc variable, usually between the 1st and 2nd antenodals, but sometimes at the 2nd or even slightly distal to it, this being more often the case in the hindwing; 8th nervure arising from the anal angle of the trigone; 2 rows of cells between 5 and *5a*.

Stigma black 2 to 3 mm.; membrane greyish, occasionally nearly white or nearly black.

Abdomen broad; the dilatation of the 2nd segment and the constriction of the 3rd but poorly marked, somewhat depressed. The male ashy blue or yellowish, especially the basal segments, the borders of the latter, the distal end of the 6th and the whole of the remainder being black. The sutures on the basal segments, including the transverse ridge on the 3rd, finely outlined in black. The 3rd to the 6th segments each with a pair of black spots beneath. In the female, the borders black and an irregular, diffuse, dark, sub-dorsal line.

Anal appendages black, the tips whitish.

Genital organs of the male: lamina high and bold, the basal part, viewed from the side, inclined to the body-axis at 45° furnished with a moderately long, largish tuft of black bristles. The apex is deeply cleft into a slightly diverging fork, nearly pointed and turning out at an angle of 90°. Tentaculæ not as high as the lamina; the sides shallowly cupped, the internal segment blunt and the hook directed laterally and horizontally. The external segment lower but prominent, flat and tumid. The lobe arched, and thickly coated with black bristles.

Genital organs of the female: border of the 8th segment dilated, foliate, at the end of the 8th ventral plate, a narrow but deep fissure with no distinct separation from the vulvar scale; 9th ventral plate swollen.

Hab. Kashmir; throughout Europe and the south of England.

16. Orthetrum japonicum internum, MacLachlan.
Orthetrum internum, MacLachlan.
Expanse 70 mm. Length 38 mm.

Head olivaceous; eyes brown above, paler, olivaceous laterally and beneath.

Prothorax : olivaceous brown.

Thorax : olivaceous brown with a broad, humeral, blackish stripe and a broad lateral stripe covering most of the space between the spiracle and the metepimeron.

Abdomen olivaceous brown with very broad, dark bordering stripes. The abdomen relatively shorter and broader than in *cancellatum.*

Wings hyaline ; a golden yellow spot at the base extending nearly as far as the 1st antenodal nervure and the cubital nervure in the forewing, and over and beyond these two points in the hind. Arc usually between the 1st and 2nd antenodal nervures or sometimes at the 2nd. 8th nervure arising from the anal angle of the trigone in the hindwing ; 2 to 3 rows of cells between 5 and *5a*.

Membrane black. Stigma bright yellow (3 mm.).

Genital organs of the male : lamina high, inclined about 60° to the body-axis; basal segment furnished with a tuft of long stiff bristles, end segment moderately narrow, blunt and divided into two small lobes by an incision at its apex. Tentaculæ of uniform height, inner segment foliate, outer only a small, blunt prominence. Lobe moderately high and a little arched.

Genital organs of the female : border of 8th abdominal segment moderately large, foliately dilated, black. End of 8th ventral plate nearly quadrilateral ; its borders tumid. Vulvar scale not distinct ; 9th ventral plate bluntly carinated.

Hab. Khasia Hills, Kashmir, Kerseong and Thibet.

17. Orthetrum trinacria, Kirby, *Cat. p.* 37 (1890).
MacLachlan, *Ent. Month. Mag.* (2) 8, p. 153 (1897).
Libellula trinacria, Selys. *Revue. Zool.* (1841), p. 244.
Lepthemis trinacria, Brauer. *Zool. bot. Wien.* 18, p. 72 (1868).
Libella trinacria, Selys.
Libellula clathrata, Rambur. *Neur.* p. 48 (1842).
Libellula Bremii, Id.
Expanse 65-71 mm. Length 47-52 mm.

Head comparatively small ; eyes just touching ; a deep indigo blue in the male; a pale opalescent green in the female; much paler beneath ; occiput large, black, with, in the female, a narrow, bisecting, median, yellow line ; occipital cavity yellow spotted with black, especially along the borders ; vesicle conical, deeply notched, black, tipped with yellow in the female : front highly glazed, translucent in the male with the sutures outlined in yellow ; pale yellowish green in the female with the base narrowly black ; epistome, labrum and labium translucent in the male ; pale opaque yellow in the female.

Prothorax : lobe high, tumid along its free border which is furnished with a fringe of hairs, deeply notched. In the male black, frosted with white or blue, in the female black with the front and sides of the lobe yellow.

Thorax robust. Male black, frosted with blue and usually with no markings unless juvenile when a broad mid-dorsal and a similar humeral band may be seen showing through the frosting. Female pale yellowish green, the sides more or less thickly frosted with blue or white. In some specimens the sides and beneath are quite white. All bear black markings more or less obscure as follows :—a broad mid-dorsal fascia, a narrow humeral streak, incomplete above and below, laterally 3 oblique, narrow fasciæ which are not always present. The sutures usually outlined in black.

Legs black in the male; yellow in the female, the femoræ being streaked with black. The femoræ bear a row of closely-set, small spines and a very long stout spine at the extreme distal ends.

Abdomen: 1st, 2nd and 3rd segments markedly dorso-ventrally dilated, the 2nd bearing a strong, angulated eminence on the dorsum, a slight constriction at the 4th and then almost parallel-sided to the end. Dorsum finely keeled, it and lateral borders minutely serrated. Male black; the first 3 segments frosted with white and the underneath completely white. Female similar in shape to the male but somewhat stouter, black marked with yellow as follows:—the first 3 segments broadly at the sides, the 4th to the 7th with a sub-dorsal stripe and a proximal sub-dorsal spot which are less marked and grow progressivelysmaller as traced towards the anal end; 8th and 9th segments all black; the 10th with a lateral, quadrate spot.

Anal appendages long, narrow and cylindrical, black, rather longer than the 9th segment in the male, and as long as the 9th and 10th in the female.

Genital organs of the male, lamina procumbent, strongly arched and over-hanging the tentaculæ; tentaculæ a pair of stout, curling hooks which first approximate in the middle line and then diverge outwards and backwards, black and highly glazed. Lobe of large size, higher than the tentaculæ.

Genitals of female: borders of 8th segment not very prominent, foliate, broadly notched; vulvar scale somewhat trumpet-shaped, keeled slightly and notched in the middle line.

Wings long and narrow, reticulation close, hyaline in both sexes. The costa and the second series of antenodal nervures bright yellow. Arc usually between the 1st and 2nd antenodal nervures; trigone in the fore-wing traversed, in the hind entire and at the arc; hypertrigones entire; antenodal nervures 10; 1 cubital nervure to all wings; subtrigone formed of 3 cells; 2 rows of discoidal cells; occasionally the field begins with one row of 3; 1 row of cells between 5 and $5a$, occasionally some doubled cells; 8th nervure in the hindwing separated from the trigonal anal angle; stigma pale yellow heavily bordered with black, 3 to 3·5 mm.; membrane moderately large, grey with a white basal border; loop well-formed; split cells at the outer angle only; apex short; basal part long and narrow.

Hab. Mesopotamia.

18. Orthetrum brunneum brunneum, Selys.
Libellula brunnea, Fonscolombei.
Libella brunnea, Braner.
Libella cærulescens, Fonscolombei.

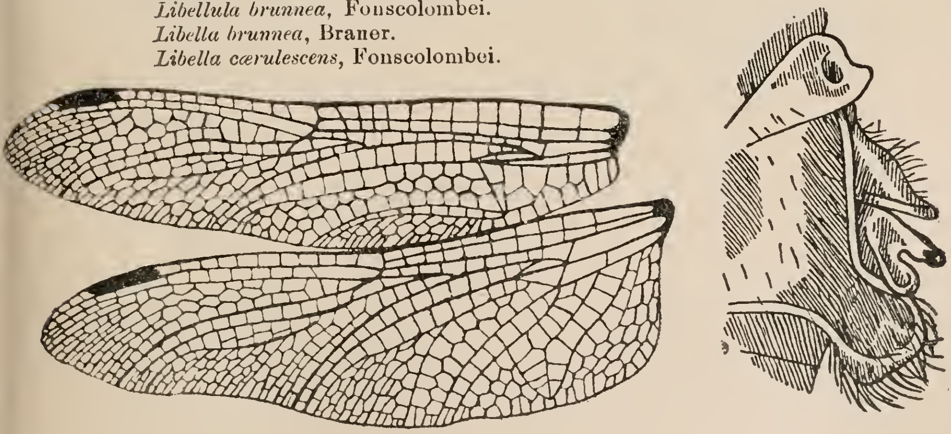


Fig. 26.—Wings and male genital organs of *O. brunneum brunneum.*
Expanse 68 mm. Length 48 mm.

Head ; eyes brown above, olivaceous at the sides and pale green below : vesicle brown ; occiput olivaceous ; epistome and clypeus pale brown or greenish brown.

Prothorax : frosted with blue in adult specimens.

Thorax : frosted entirely with bright blue in adult specimens. Juvenile males and females with short, brownish, humeral bands and 2 lateral, diffuse, whitish-yellow stripes. The humeral stripe bordered with dark brown ; the lateral bands extending from humeral region to spiracle and the posterior one covering the greater part of the metepimeron. The general ground colour a dirty brown or pale yellow.

Legs brown.

Wings : arc between the 1st and 2nd antenodal nervures ; 2 rows of cells between 5 and *5a* : 8th nervure in the hindwing at the anal angle of the trigone ; trigone in the hindwing often traversed ; antenodal nervures 12-16 ; base of wing entirely hyaline, or short, saffronated rays in the hind.

Stigma small, reddish-brown ; membrane white.

Abdomen of the male, the base laterally slightly, dorso-ventrally but little more dilated. Broad and depressed and gradually tapering to the end. Frosted entirely with bright blue. In the female nearly cylindrical, yellowish or greyish brown, with narrow dark borders. Brighter coloured beneath.

Genital organs of male : lamina low, broad and flat, inclined to body-axis at about 30°, the end rounded and slightly notched. Tentaculæ uniformly high, the internal a blunt hook, directed somewhat to one side and backward. The external separated from it by a somewhat deep notch, a little depressed, cupped and oval in shape. Lobe moderately high and rather shallowly arched. The whole very small.

Genital organs of the female : lateral border of the 8th abdominal segment fairly strongly dilated, its border spined and bordered with black. End of 8th ventral plate with a small shallow incision, small yellowish lobes projecting a little posteriorly ; 9th ventral plate tumid, flattened and furnished with strong, broad, lateral hooks.

Hab. Quetta ; Kashmir, Assam.

19- O. tœniolatum, Kirby.
Libellula tœniolata, Schneider.
Libellula tœniolata, Brauer.
Libellula anceps, Selys.
Orthetrum brevistylum, Kirby.
Orthetrum hyalinum, Kirby.
Expanse 50-60 mm. Length 35-40 mm.

Head ; eyes brown above, pale opalescent green at the sides and beneath ; occiput, and vesicle olivaceous ; epistome and clypeus pale olivaceous or pale yellow ; labrum yellow.

Prothorax : frosted with blue, no markings.

Thorax : in adult males, frosted with blue and the markings barely or not discernible ; in juvenile males, a broad, light brown fascia on the mid-dorsum bordered outwardly by pale olivaceous, a broad, humeral, warm brown fascia bordered anteriorly and posteriorly with black, laterally 2 broad, brown fasciæ, bordered in front by a pale whitish green stripe, the hind fascia covering the whole of the metepimeron.

Legs black, the femoræ yellow at the bases. Frosted densely with blue which conceals most of the colouring.

Wings : arc between the 1st and 2nd antenodal nervures or occasionally opposite the 2nd ; 2 rows of cells between the 5th and *5a*, even in the smallest specimens ; 8th nervure at the anal angle of the trigone or occasionally a shade separated from it; 10-12 antenodal nervures; hypertrigones entire; trigone in forewing traversed, in the hind, entire.

Stigma small, narrow, bright yellowish brown, bordered heavily with dark brown along the costal border, 2 5 mm; costa and the second series of the antenedal nervures and the cubital nervure, yellow. Membrane white, grey at the free border; bases of wings completely hyaline or there may be in the females, rays in the inferior costal and cubital spaces.

Abdomen: very slightly dilated laterally at the base, moderately to strongly dorso-ventrally. Narrow and tapering near the anal end. Entirely frosted with bright blue but in juvenile males, with markings showing through; a narrow black, mid-dorsal line and dark, lateral broader lines.

Anal appendages black, frosted with blue.

Genital organs of the male; lamina broad, procumbent, inclined to body-axis 30°, rounded, at the apex, slightly notched, the surface covered fairly densely with long fine, grey hairs. Tentaculæ small, nearly triangular, laterally cupped. The internal tentacula with a somewhat blunt hook, bent backwards and outwards; the external not noticeable, apparent only as a broad, transverse swelling at the side. Lobe broadly rounded.

Female: markings as in the juvenile males but much better defined. The narrow whitish green stripes on the sides are very conspicuous and the brown fascie are well defined.

The legs ochreous or paler yellow.

Abdomen: very slightly dilated at the base, then cylindrical and more robust than in the male. Yellowish brown in colour; the mid-dorsal ridge black with a tendency to beading; the borders especially of the hinder segments broadly dark brown. This latter often not present in the basal segments.

Genital organs of the female: border of 8th segment not dilated; end of 8th ventral plate nearly straight, not tumid.

This species which is the smallest of the genus, shows like many of the others, great polychroism, although markedly constant in its morphology

Hab. Generally throughout Continental India; Kashmir below 5,000′; Nilgiris below the same altitude; Ceylon and Burma.

20. **Orthetrum anceps,** Kirby.

Libellula anceps, Schneider and Brauer.
Libella anceps, Schneider and Brauer.
Libellula ramburii, Selys and Brauer.
Orthetrum ramburii, Mac Lachlan.
Expanse 58 mm. Length 40 mm.

Head; eyes olivaceous brown above, paler beneath; vesicle brown; face and labrum brownish or olivaceous.

Prothorax: brown frosted with blue.

Thorax: frosted completely with blue with some dark markings and a yellowish brown tint showing through; this more evident in juvenile males.

Abdomen: frosted with blue. Much dilated dorso-ventrally but not at all laterally, depressed and near the end, tapering gradually.

Female similar but no blue frosting; the sides of the thorax yellowish brown with black markings. The abdomen yellowish brown, nearly cylindrical. In old specimens occasionally a little blue frosting.

Wings; antenodal nervures 10-12; arc usually at the 2nd antenodal nervure but not uncommonly between the 1st and 2nd; generally only 1 row of cells between 5 and *5a* but occasionally a few doubled cells, especially in the female: 8th nervure arising from the anal angle of the trigone.

Membrane white. Stigma large, 3-4·5 mm. relatively broad, yellow to bright yellowish brown. Bases completely hyaline, in juvenile males; at times, a light yellow.

Genital organs, male: lamina bold, the basal part inclined to the body-axis at 60°, the apex blunt, moderately narrowly but deeply notched and its extreme end almost perpendicular to the body-axis. The tentaculæ uniformly high, the internal short and furnished laterally with a small hook, separated from external by a narrow fissure. The external deeply concave, its border curling somewhat, Lobe not as high as tentaculæ, arched.

Genital organs of female: border of 8th segment a little dilated, only the outer border black; end of 8th ventral plate very shallowly notched and somewhat prominent; 9th ventral plate somewhat carinated, tumid and depressed.

Hab. Europe, North Africa and Quetta.

I have not seen specimens from Quetta but I have a number which I took at Suez. In these, there is but little blue frosting on the thorax, the abdomen however being a bright blue. Laterally the thorax has two broad, brown fasciæ separated by a bright, whitish yellow stripe. There is also a brown, humeral stripe bordered by dark brown anteriorly. The females (all juvenile specimens) have no blue frosting whatever. The humeral stripe and the lateral fasciæ are well defined. The abdomen is ochreous, bordered with dark brown.

The antenodal nervures number 11-13; there is only 1 row of cells between 5 and *5a* but occasionally 2 or 3 double cells. The arc is always at the 2nd antenodal.

21. Orthetrum ransonnetti, Kirby.

Libellula ransonnetti, Brauer.
Libella ransonnetti, Brauer.
Libellula gracilis, Selys.
Orthetrum gracilis, Kirby.

Expanse: Male 70 mm. Length, 50 mm.
Female 72 mm. ,, 56 mm.

Head; face and forehead light yellowish green: the forehead flattened; the border somewhat rounded. Eyes bottle green above, paler beneath.

Vesicle and occiput olivaceous or brownish.

Prothorax: olivaceous.

Thorax: frosted with blue.

Legs dark, the bases and curved sides of femoræ, a streak on the flat sides of femoræ and a streak on the tibiæ, black.

Wings: arc between antenodal nervures 1 and 2; only 1 row of cells between 5 and *5a*; hypertrigones entire; 8th nervure at the anal angle of the trigone or it may be a little separated; membrane white; bases entirely hyaline; stigma very small, a reddish brown; the costa and the nervures in the basal area of the wings, the antenodal nervures and those posterior to them, a bright yellow, especially in juvenile males and females. In the adult males the nervures usually dark. Antenodal nervures 9 to 11.

Abdomen: slightly from side to side and strongly, dorso-ventrally dilated and with a very prominent, angulated keel on the proximal part of the dorsum of the 2nd segment. Remainder of abdomen narrow, with the sides nearly parallel. Frosted with blue or often black with little or no frosting.

Genital organs of the male: lamina not particularly large, the apical half nearly at a right angle to the basal part, broad, triangular and obtuse; tentaculæ very small and nearly semi-circular as seen from the side, strongly cupped and without a distinct external segment; the internal segment laterally deflected at a right angle. The lobe large, overlapped slightly by the tentaculæ.

Female rather brighter coloured.

Head; face, forehead and labrum very pale, almost white and diaphanous, the labrum often yellowish.

Thorax: front and laterally a bright yellowish brown, somewhat olivaceous. Darker at the sides, black beneath.

Abdomen: the base somewhat dilated but less so than in the male; more robust than in the male; yellowish brown in colour; 2 dark spots near the apical border of each segment, this border being edged narrowly with blackish brown; beneath black with narrow, reddish, lateral spots.

Genital organs of female: border of 8th segment not dilated; border of 8th ventral plate shallowly arched at the end; 9th ventral plate not prolonged at the end.

There is a strong tendency to irregularities in the neuration of the wings of this species.

Hab. Mesopotamia, Muscat, and Persia.

22. Orthetrum chrysostigma luzonicum, Ris.
Orthetrum chrysostigma, Selys.
Orthetrum luzonica, Kirby.
Orthetrum tricolor, Kirby.
Libella luzonica, Brauer.

Expanse 60 mm. Length 40 mm.

Head; eyes brown above, olivaceous at the sides, fading to greenish yellow beneath; forehead usually with a well-defined, black basal line; epistome, clypeus and labrum yellow or greenish yellow; labium yellow margined with black or else completely black; vesicle blackish brown; occiput dark olivaceous.

Prothorax: greenish yellow with a fine, median, black collar just in front of the lobe

Thorax dark olivaceous green with a darker humeral or post-humeral fascia, bordered anteriorly with a dark chestnut brown, humeral stripe, and behind by a similar stripe which is however more irregular. Laterally a light greenish yellow with 2 very obscure darker stripes. Beneath and occasionally the whole of thorax, in very adult specimens, frosted with blue. The tergum a pale greenish yellow. In some specimens, the sides are much darker and the greenish yellow tint is almost hidden by black, which also spreads over the ventral surface.

Legs; anterior femoræ yellow; the tibiæ yellow on the outer and black on the inner side; the middle and hind legs black, striped with yellow on the outer sides of the femoræ.

Wings hyaline; 1 to 2 rows of cells between 5 and 5*a*; 12 to 13 antenodal nervures; 8th nervure well separated from the anal angle of the trigone in the hindwing; arc at the 2nd antenodal in the forewing, between the 1st and 2nd in the hind.

Membrane black; stigma ochreous, heavily bordered with black, 3 to 3·5 mm.; costa and antenodal nervures yellow.

Abdomen: moderately dilated at the base, then cylindrical and parallel-sided to the anal end; very variable in colouring, either all black and more or less frosted with blue or else the anterior segments a greenish yellow (usually the 1st to 3rd); the sutures finely mapped out in black, a diffuse, sub-dorsal, brown stripe. The rest of the abdomen obscurely greenish yellow and bordered on either side, broadly with black. The whole of the segments, 4 to 10 usually frosted with blue through which the markings show more or less faintly.

Genital organs of the male: lamina wide and procumbent, covered to a variable extent with long, coarse hairs, its sides laterally curling or thickened and the apex notched. Internal tentacula foliate and membranous, ending in a small, outwardly directed hook; external tentacula broadly triangular and cupped on the outer surface; the lobe not projecting, sloping well back, broad, shallowly arched and coated with stiff, coarse hairs.

Female: very similar to the male but rather brighter coloured.

Head: eyes are paler, the labrum and the face a brighter green.

Thorax: always a light yellowish green laterally and with practically no markings.

Abdomen: similar to the male but the black bordering narrower and consequently the greenish yellow more extensive. No blue frosting as in the male. Much stouter than in the male and cylindrical.

Anal appendages small and black.

Wings hyaline, often with a marked smokiness. With or without a basal marking, which, if present, extends in the forewing as far as the 1st antenodal nervure and the cubital nervure; in the hindwing it extends as far as the 2nd antenodal, nearly as far as the trigone and into the border of the loop.

Genital organs of female: 8th abdominal segment markedly dilated; vulvar scale small, deeply notched and semi-bipartite; 9th ventral plate tumid.

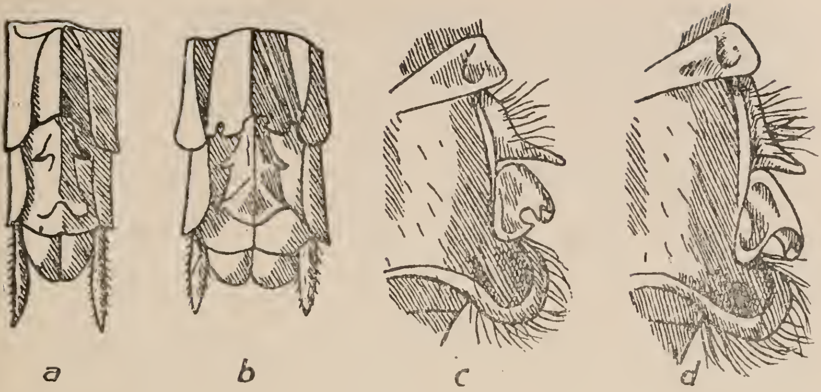
Remarkable polymorphism and polychroism is found in this species and gives rise to much confusion in classification. The blue frosting of the male is extremely variable, some specimens being densely frosted whilst others have the merest trace. The thoracic markings vary widely, Ris describing specimens from the Nilgiris, gives the markings as very extensive, whilst in the specimens that I possess from the same locality, save for the humeral stripe, the markings are almost or entirely obsolete.

The dark, basal line on the forehead seems to be constant, being present in specimens from Ceylon, Nilgiris, Burma and Malabar. Specimens from Deesa agree with my Nilgiri ones. The labium varies in its colouration considerably; thus Ris describes a pair from Burma, where the labium of the male is completely black, and in the female, only the middle lobe similarly coloured. In Nilgiri specimens the labium is usually completely yellow. Burma specimens possess 1 row of cells between 5 and *5a*, as do also those from Gilgit, whilst, others from the Nilgiris, Deesa, and Ceylon may have either 1 or 2 rows of cells.

Hab. Throughout India except the desert tracts, Nilgiris, Ceylon and Burma.

23. **Orthetrum triangulare triangulare,** Kirby.

Libella triangularis, Selys.
Libella deleserti, Kirby.
Orthetrum deleserti, Kirby.
Orthetrum carnaticum, Kirby.



27

Fig. 27.—a. Female genital organs of *O. glaucum.* b. Female genital organs of *O. triangulare.* c. Male genital organs of *O. pruinosum.* d. Male genital organs of *O. triangulare.*

Male :

Head ; eyes just meeting, brown above, olivaceous and paler at the sides and beneath ; vesicle prominent deeply notched, black ; face brown, labrum and labium greenish yellow ; suture deep.

Prothorax : dark brown, the lobe furnished with a very long ruff of hairs.

Thorax : a deep chestnut brown, almost black, laterally a bright greenish yellow traversed by a broad brown stripe. The dark brown parts are densely pubescent ; the yellow parts naked.

Legs robust, black ; hind femoræ with a row of stout ; gradually lengthening spines ; the mid-femoræ similar but the spines much less numerous. Claw-hooks robust, nearer base than apex. Tibial spines fairly numerous, long and robust.

Wings broad and long ; arc between the 2nd and 3rd antenodal nervures or at the 2nd ; sectors of arc short in the forewing, longer in the hind ; trigone in the forewing traversed once or twice ; its proximal side somewhat sinuous ; trigone in the hindwing traversed ; its distal side concave ; hypertrigone in the forewing traversed, in the hind entire ; 15 to 17 antenodal nervures ; the loop broad and long ; its mid-rib bent to nearly a right angle and with split cells both at the trigone and at the outer angle ; discoidal field broadly dilated, with 3 rows of cells ; 8th nervure at the anal angle of the trigone in the hindwing ; 2 rows of cells between 5 and *5a*.

Stigma dark brown, large. Membrane dark grey. At the base of the hindwing a dark, opaque. blackish brown, triangular mark reaching in the superior costal space to the 1st antenodal nervure, in the inferior costal space to the 2nd, rather more than half-way over the sub-costal and cubital spaces and from thence sloping gradually to about the middle of the membrane. Just a suspicion of a brownish black mark in the forewing.

Apices of wings faintly smoky.

Abdomen, ventro-dorsally, dilated at the base, then markedly depressed as far as the 7th segment, from which point to the anal end it is strongly carinated. Markedly fusiform, the broadest part at the 4th and 5th segments ; 1st and 2nd segments deep mahogany brown, the 1st segment being densely coated with long hair, especially at the sides ; 3rd to 7th bright cobalt blue ; the remaining segments black.

Anal appendages black, long, cylindrical and a little sinuous.

Genital organs: lamina somewhat depressed, its end somewhat tapering, in front coated thinly with long, coarse, black bristles; tentaculæ small, the internal, a hook, curving on itself and separated from the external by a shallow notch; the external slightly overlapping the lobe, depressed and somewhat rounded. Lobe large, rounded.

Female: rather more robust than the male.

Head; eyes olivaceous above, opalescent slaty blue laterally and below; labrum and labium yellow; face greenish yellow.

Prothorax and thorax: a golden brown with a greenish tinge. A broad, brown, diffuse, humeral stripe. Laterally, similar to the male, the contrast in the colour not being nearly so marked on account of the paler ground colour.

Abdomen: golden brown or yellowish, the first 3 segments with a marked greenish tinge. The mid-dorsal ridge darker and a bordering of diffuse, greenish lunules. Beneath yellowish, lateral spots on each segment.

Female genital organs as shown; the border of the 8th segment markedly dilated; stout lateral spines on the border of 9th ventral plate.

Wings: a bright, golden yellow spot on the basal area of the hindwing extending outwardly as far as the basal spot in the male, but not as far back as the middle of the membrane.

Legs paler than in the male, femoræ a golden yellow at the base and on their inner surfaces.

In females from the Nilgiris the mid-dorsal ridge and the sutures and intersegmental nodes are all finely mapped out in black. There ia a broad sub-dorsal brownish fasciæ extending the whole length of the abdomen and covering most of the area of the hinder segments. A greenish yellow stripe on the tergum is continued on to the first 3 segments of the abdomen.

Hab. Burma, Sikkim, Khasia Hills. Murree, Kashmir 5,000′. Nilgiris and Ceylon 6,500′.

24. **Orthetrum glaucum,** Kirby. *Cat. p.* 39 (1890).
Id. Jour. Linn. Soc. Zool. 24, *p.* 555 (1893).
Karsch, Kruger and Martin.
Orthetrum Nicèvillei, Kirby, *An. Mag. Nat. Hist.* 14, 112 (1894).
Laidlaw, *Proc. Zool. Soc Lond.* (1902) 1, *p.* 68.
Libellula glauca, Brauer (1865), *Zool bot. Wien.* 15, *p.* (1012).
Libella glauca, Brauer (1868), *Zool. bot. Wien.* 18, *p.* 732.

Head; adult male; face black, the epistome somewhat paler or a bright brown; forehead a deep black, it and the vesicle a dull, metallic blue by reflected light. In the juvenile male and the female, the face and forehead a bright yellow.

Prothorax, thorax and abdomen of the adult male: entirely frosted with a dark blue. Juvenile males and females olivaceous with broad, diffuse, humeral bands and laterally 2 bright, greenish yellow bands. one anterior and the other covering the front half of the metepimeron.

Legs black in adult males, brown or yellowish in juvenile males and in females.

Wings: trigone in the hindwing entire; arc between the 2nd and 3rd antenodal nervures; 2 rows of cells between 5 and *5a*: 8th nervure in the hindwing arising from the anal angle of the trigone.

Membrane black.

In the male, a golden brown, basal spot in the hindwing extending as far as the 1st antenodal nervure, somewhat beyond the cubital nervure and about 2 cells beyond the end of the membrane. The reticulation is in this spot in adult forms frosted with blue. The costa narrowly yellow.

Genital organs of the male: lamina very depressed in its basal half, 30°. then turning abruptly outwards and at its extreme apex, curling forwards, Apex fairly acute. Internal tentaculæ furnished with a bold spur which is bent somewhat to one side at its apex, separated from the external tentaculæ by a moderately, deep, arched fissure. Lobe high and strongly arched.

Genital organs of the female: border of 8th segment, narrowly and foliately dilated, the dilatation black and strongly toothed; end of 8th ventral plate notched slightly; 9th ventral plate flatly arched.

Anal appendages in both sexes black.

Hab. Ceylon, Bengal, Burma, Tennasserim, Khasia Hills, and Nilgiris.

Specimens from the Nilgiris vary widely in the females. The measurements of the two sexes are as follows:—Male, expanse 80 mm. Length 56 mm. Female, expanse 72 to 78 mm. length 45 to 48 mm. The abdomen of the males is long, moderately narrow for its length, depressed and a bright, cobalt blue, the hinder half of the 8th and the whole of the 9th and 10th segments being black. The thorax in the female is a rich chocolate brown, variably overlaid with a blue frosting which more or less obscures the markings according to the age of the specimen. The dorsum is inclined to be bronzed and is distinctly paler. There is a pale, whitish yellow stripe on the tergum and 2 more or less bright, moderately narrow, whitish yellow stripes on the sides which become obsolete as traced upwards. The abdomen is stouter and shorter than that of the male, a dark olivaceous tint, the borders and sub-dorsum diffusely black. Beneath, on each segment, are a pair of bright yellow lunules. The first 3 segments of the abdomen are often thinly frosted with blue.

The wings are not uncommonly, faintly smoky, especially at the apices. Stigma brown, bordered with black. 3·5 mm.

Hab. Nilgiris 5,000′ to 6,000′.

25. Orthetrum sabina, Kirby.

Libellula sabina Drury.
Lepthemis sabina, Brauer.
Libella sabina, Selys.
Orthetrum sabinum, Ris.
Liebellula gibba, Fabricius.
Orthetrum divisum. Kirby.
Libellula leptura, Burmeister.
Orthetrum leptura, Kirby.
Orthetrum lepturum, Needham.
Libellula ampullacea, Schneider
Lepthemis divisa, Selys.

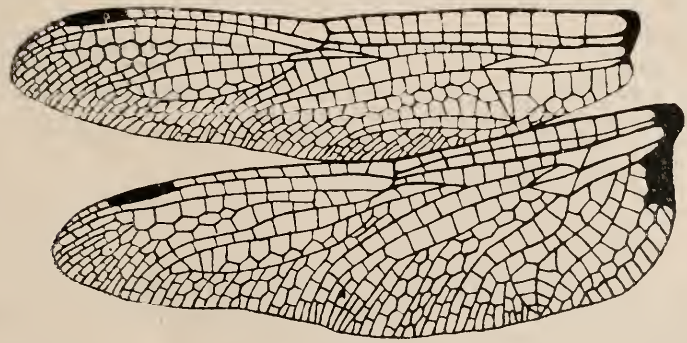


Fig. 28.—Wings of *Orthetrum sabina* (x2).

Expanse 70 mm. Length 50 mm.

Head: occiput olivaceous; eyes a bottle green, paler beneath; epistome, clypeus and labrum, a greenish yellow, the upper part of former, blackish; vesicle brown.

Prothorax: the anterior and middle lobes black with a fine bordering of yellow anteriorly, the posterior lobe yellow.

Thorax: greenish yellow with the following black markings:—a fine, mid-dorsal line, a narrow humeral line, 4 narrow lateral lines and an incomplete line on the metepimeron. The forepart of tergum and the attachments of the wings on either side of tergum powdered with cobalt blue, this latter more evident in old specimens. Beneath greenish yellow, the sutures outlined in black.

Legs; outer surfaces yellow, inner black.

Wings hyaline, the costa and many nervures at the base, principally the antenodal and cubital, yellow. At the base of the hindwing a small basal marking extending along the membrane for about 2 cells width and in the cubital space for not quite half-way to the cubital nervure. 12-13 antenodal nervures; arc between the 2nd and 3rd antenodal nervures sometimes at the 2nd and rarely between the 1st and 2nd; 8th nervure widely separated from the anal angle of trigone in the hindwing; trigone and hypertrigone in the forewing traversed, in the hind, both entire.

Stigma a bright yellowish brown, 3·5 mm.; membrane black, occasionally spotted with yellow.

Abdomen: segments 1 to 3 laterally, slightly, ventro-dorsally, greatly dilated; the 3rd narrowing rapidly, the 4th, 5th and 6th slim and cylindrical, the 7th, 8th and 9th strongly, ventro-dorsally dilated. Segments 1 to 3 yellowish-green with the sutures, including the transverse ridge on the 3rd, mapped out finely in black, the remaining segments black with long, oval spots of yellow on the borders of the 4th to 6th. In very adult specimens, there is often a thin, white frosting to the underside of the thorax and abdomen and entirely frosted specimens are not unknown, the variation in the colour and markings being extremely wide.

Anal appendages: a pale green, almost white.

Colouration of female: very similar to that of male.

Genital organs of male: lamina prominent, inclination to the body axis 45°; the apical part more so, about a right angle, and somewhat tapered, furnished with 2 tufts of stout, yellowish bristles which diverge strongly from one another. The internal tentacula with only a small hook, the external depressed, black, strongly concave and shell-like; the lobe longitudinally broad, shallowly arched and coated thickly with stout, coarse bristles.

Genital organs of female: border of 8th segment, moderately foliately dilated, strongly spined. End of 8th ventral plate flatly arched, notched, the borders of the notch turning outwards; 9th ventral plate in its basal half steeply carinated, in the apical half, swollen.

Hab. All India, Ceylon and Straits; Mesopotamia and Basra.

26. Orthetrum testaceum testaceum, Ris.

Orthetrum testaceum, Kirby.
Libellula testacea, Burmeister.
Erythemis testacea, Brauer.
Libella testacea, Brauer.

Expanse 36 to 40 mm. Length 66 to 74 mm.

Head; forehead orange or reddish; face yellow; eyes opalescent slaty blue, paler beneath; vesicle and occiput brownish.

Prothorax: golden brown.

Thorax: reddish brown; no markings; often a thin bluish frosting present

Abdomen slighly dorso-ventrally dilated at the base, moderately constricted at the 3rd segment, then moderately broad and depressed and tapering gradually to the end. Bright scarlet red.

Wings relatively long; trigone in the hindwing traversed; arc between the 2nd and 3rd antenodal nervures; 2 rows of cells between 5 and *5a*; 8th nervure arising from the anal angle of the trigone in the hindwing; brown basal marking in the hindwing extending as far as the 2nd antenedal and the arc.

Membrane black. Stigma reddish brown, 3 mm.

Female: a golden brown, the sides of thorax and the abdomen with an olivaceous or greenish tinge. The sutures and mid-dorsal ridge finely outlined in black. The borders of the abdomen and the end segments, as well as the dilatation of the 8th segment, diffusely black.

Genital organs of the male: lamina moderately depressed (30°), the terminal part turning out somewhat, the outer surface not markedly furnished with hairs and no special tuft of bristles. Tentaculæ of uniform height, short and blunt; the two segments separated by a fairly broad notch. Lobe much broadened in the length of the insect, scarcely arched.

Genital organ of the female: border of the 8th segment foliately broadened; end of 8th ventral plate projecting in the middle line as a small, obtuse angled vulvar scale with a small, rounded lobe on either side of it. Border of 9th segment rounded and the 9th ventral plate tumid, not prolonged.

Hab. India, N.-E. Burma and Sikkim.

27. **Orthetrum chrysis,** Ris: Kruger.

Libella testacea race *chrysis*, Selys.

Expanse 68 mm. Length 40 mm.

Head; eyes brown above, paler at the sides and beneath; vesicle and occiput olivaceus or pale brown; forehead dark red or ochreous; face and labrum pale ochreous or yellow.

Prothorax: ochreous.

Thorax: dark red or occasionally a dark, rich ochreous without any markings. Abdomen dark red or rich orange yellow.

Legs yellow or pale brown.

Wings relatively short; the basal spot in hindwing smaller than in *O. testacea*, extending only as far as the antenodal nervure, to the cubital nervure, and for about 2 to 3 cells beyond the end of membrane; trigone in the hindwing traversed as a rule: arc between the 2nd and 3rd antenodal nervures; 2 rows of cells between 5 and *5a*; 8th nervure arising from the anal angle of the trigone in hindwing; membrane black; antenodal nervures 15.

Stigma blackish brown (3 mm.). The basal spot in the hindwing a golden brown colour.

Female: similar but a darker, ochreous or olivaceous brown colour.

Genital organs of the male; lamina differing very slightly from that of *O. testacea*, but the outer surface furnished with a tuft of markedly sloping, stiff, black hairs; the fissure separating the tentaculæ rather deeper than in *testacea*; lobe moderate, arched.

Genital organs of the female: very similar to *testacea*.

Hab. India generally and Ceylon.

The distinctions between this insect and *testacea* are not very striking and they may be but local varieties. The small size of the basal marking in the hindwing and the tuft of hairs on the lamina are the most striking points. Specimens taken in Poona are all a brilliant ochreous yellow and are usually taken away from water in company with *pantala*.

28. Orthetrum pruinosum neglectum, Ris.

Libellula neglecta, Rambur.
Libella neglecta, Selys.
Orthetrum neglecta, Kirby. *Cat. p.* 182 (1890).
Morton, *Trans, Ent. Soc., Lond.* (1907), *p.* 305.
Libellula petalura, Brauer.
Libella petalura, Brauer.
Orthetrum petalura, Kirby, *Cat. p.* 39 (1890).
Libellula pruinosa, Brauer.
Orthetrum pruinosum, Kirby, *Proc. Zool. Soc. Lond.* (1886), p. 327.
Libella pruinosa clelia, Selys.
Orthetrum pruinosum ceylanicum, Forster. 1903, p. 541. *Ann. Mus. Hung.*

Male: Expanse 72 mm. Length 45 mm.

Head ; eyes a deep, blackish blue above, slaty blue beneath ; occiput vesicle and face a dark brown ; upper part of epistome and forehead a dull metallic blue black.

Prothorax : dark crimson overlaid with a thin blue frosting.

Thorax a rich, dark crimson overlaid with blue frosting which gives it a rich violet tint, reminding one of the bloom on a damson. No markings. Legs black.

Wings long and broad, hyaline, often a little smoky at the apices ; a dark amber-coloured patch in the basal area of the hindwing extending as far as the 1st antenodal nervure and slightly beyond the cubital nervure, over 1 or 2 cells of the loop and 2 to 3 cells beyond the end of the membrane.

Stigma dark brown, almost black, 3 mm. ; membrane grey or black.

Trigone in the hindwing traversed ; 2 rows of cells between 5 and *5a* ; antenodal nervures 14 to 15 ; loop well formed, split cells at the trigone and at the external angle ; 3 rows of cells in discoidal field.

Abdomen markedly, dorso-ventrally dilated at the base, then moderately broad, parallel-sized and markedly depressed. A rich crimson without any markings and overlaid, especially the first 3 segments, with a thin blue frosting which gives it a violet appearance.

Anal appendages : crimson, short, cylindrical.

Genital organs ; lamina procumbent, only the apex turning out a little ; inclination to the body axis about 30°; the outer surface furnished with long, stiff black bristles. The inner segment of the tentaculæ furnished with a backwardly and somewhat outwardly directed hook and separated from the external segment by a moderately deep, arched fissure. Lobe moderately procumbent, rounded and arched.

Female : Expanse 65 mm. Length 43 mm.

Head ; eyes warm brown above or occasionally a bottle green, slaty blue beneath ; occiput olivaceous brown : vesicle, clypeus and labrum olivaceous and glassy or diaphanous.

Prothorax brown.

Thorax varies considerably in its colouring. The ground colour may be a dull olivaceous brown with obsolete markings or it may be a golden, brown with a greenish tinge. A broad, humeral, brown fascia bordered in front and behind with black and the black border in front again bordered with pale whitish green ; laterally olivaceous brown or pale greenish yellow with a median black streak.

Legs olivaceous at the bases of femoræ, black beneath and at the distal ends of femoræ and the tibiæ.

Wings hyaline ; the apices faintly smoky. No basal markings to hindwings. Antenodal nervures 12.

Abdomen : usually an olivaceous brown with obscure yellow spots along the borders. Often there is a broad, mid-dorsal, black streak which expands at the distal end of each segment and the marginal spots may be obscured by a black bordering or a diffuse brown.

Anal appendages : short, cylindrical, brown.

Genital organs : 8th abdominal segment with a narrow, foliate dilatation of its borders.

Hab. India throughout, Ceylon and Burma.

(To be continued.)

NOTES ON THE BIRDS OF AMBALA DISTT., PUNJAB

BY

H. WHISTLER, M.B.O.U., F.Z.S.

PART II.

(*Continued from page* 681 *of Volume XXV.*)

813. The Swallow—*Hirundo rustica*, L.

This swallow was definitely identified on the following occasions :—1 at Ambala on November 1st, 1 near Jagadri on November 30th, a party at Ambala on 10th December, 3 at Rupar on 21st March, and a party in Cantonments on 10th April.

818*. The Wire-tailed Swallow—*Hirundo smithii*, Leach.

"I have frequently heard from my late friend Dr. Scott that this swallow occurs in some abundance about Ambala in certain seasons, and breeds there" (Beavan). I met with three only, at Chandighar on 10th November, and at Ambala on 21st and 23rd November. It is doubtless a summer resident.

823. Syke's Striated Swallow—*Hirundo erythropygia*, Sykes.

Striated swallows were common and generally distributed during my stay in the district, and were probably for the most part if not entirely of this species. The only specimen preserved proved to be Sykes Striated Swallow. A few must breed in the district as I saw one of their old nests under a culvert.

826. The White Wagtail—*Motacilla alba*, L.

This common winter visitor had already arrived when I reached the district on the 23rd of October and it continued abundant until my departure on 20th April. It was generally distributed except in the low hills about Kalka and Kasauli where I did not meet with it.

Beavan has a long note on this species under the name of *Motacilla luzionensis* in which he gives the dates of its arrival as follows :—

1863. Ambala. September 8. (Dr. Scott.)
1864. Sunawar near Kasauli. September 8. (Dr. Scott.)
1865. Ambala. September 30. "Abundant, have been in some days" (Dr. Scott.)
1866. Ambala. Sept. 11. Dr. Scott.

He states also on the authority of Dr. Scott that it leaves Ambala about the end of April.

829. The Masked Wagtail—*Motacilla personata*, Gld.

A common winter visitor but less numerous than the last species with which it freely consorts. It was observed in the same localities and for the same period.

831. The Large Pied Wagtail—*Motacilla maderaspatensis*, Gm.

One was seen at a masonry tank at Jagadri on 30th November, and two more at a shrine near the river at Rupar on 18th December.

832. The Grey Wagtail—*Motacilla melanope*, Pall.

Generally dispersed throughout the district and almost always solitary ; this Wagtail was observed on 20 dates between 23rd October and April 12th.

Beavan says that Dr. Scott observed the species. "In 1863 in Ambala on September 3rd ; and in 1866, on 21st September, upwards of 50 in a flock." This last record if correct is most remarkable, but I fear that it more probably referred to some other form of Wagtail.

833. The Grey-headed Wagtail—*Motacilla borealis*, Sundev.

835. The Indian Blue-headed Wagtail—*Motacilla beema*, Sykes.

Both these races of Wagtail occur in the district, but in the absence of a sufficient number of specimens obtained, I was unable to work out their status. Yellow Wagtails of sorts were noted in December, February and March, and became most abundant on passage in April.*

837.* The Yellow-headed Wagtail—*Matacilla citreola*, Pall.

838. Hodgson's Yellow-headed Wagtail—*Motacilla citreoloides* (Hodgs.)

Yellow-headed Wagtails were observed commonly about the marshes of Chamkaur on 13th and 14th December, and a few were seen on other dates in the winter, with an increase on migration in April. Both forms were probably represented but I failed to secure a series to settle the point.

840. The Tree Pipit—*Anthus trivialis* (L.).

Met with in small numbers from the beginning of November until the end of February: during March it seemed to become more numerous, and at the end of that month and during the first half of April there were certainly a number passing through on the spring migration.

844*. The Brown Rock Pipit—*Anthus similis* (Jerd.).

A large Pipit which was probably of this species was seen on the edge of the Ghaggar Nala at Chandighar on 13th February.

848*. The Tawny Pipit—*Anthus campestris* (L.).

Observed in small numbers about the neighbourhood of Civil Lines from November to the middle of January.

851.*a*. The Central Asian Pipit—*Anthus blakistoni* (Harlut.).

This Pipit was found in great numbers about Mubariqpur from 5th to 7th November ; it was frequenting the coarse rushy grass on the banks of the Ghaggar, and also the rice fields and swampy ground of the marshes there. When I visited this same ground on 19-20th February the numbers were gone, but there were a few Pipits about, which may have been of the same species.

A number of Pipits met in similar situations at Chamkaur on 13th and 14th December, and by the Sutlej at Rupar on 22nd March were attributed to this species, but no specimens were obtained.

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* Beavan has a short note on *Motacilla viridis* but not of sufficient value to merit any speculation as to its identity. The same name occurs in Dr. Scott's catalogue.

853. The Upland Pipit—*Oreocorys sylvanus* (Hodgs.).

This curious Pipit was common on the open hillside of the northerly face of Kasauli when I was there early in March. It was not shy and would allow a close approach before rising. The call or song is a curious sawing creaking sound of several notes, rather ventriloqual and difficult to locate, and is uttered both from the ground or a tree top. Although the species appeared to be already paired the organs of two birds shot were not yet developed.

859. The Eastern Calandra Lark—*Melanocorypha bimaculata* (Men.).

An Editorial note to Captain Beavan's account of this species, which he had never met in the wild state, says:—"Lord Walden informs us that he has received many specimens of this species shot in the neighbourhood of Ambala." In Dr. Scott's list there is the note, "in thousands this year."

I met with two flocks of Larks which I attributed to this species, namely between Bilaspur and Jagadri, on 30th November, and near Ambala on 15th February, but no specimens were obtained.

862. The Short-toed Lark—*Calandrella brachydactyla* (Leisl.).

A winter visitor occurring in flocks and noted at Ambala, Morinda and Mubariqpur. As no specimens were collected it is impossible to be certain of the race represented.

867. The Indus Sand-lark—*Alaudula adamsi* (Hume).

Found in small numbers frequenting the bed of the Ghaggar river at Mubariqpur in November and February.

869. The Singing Bush-lark—*Mirafra cantillans*, Jerd.

One or two were observed between Bilaspur and Jagadri on 30th November.

871. The Red-winged Bush-lark—*Mirafra erythroptera*, Jerd.

"At Ambala, November 13th, 1866, I shot a specimen in a small enclosed garden. It alighted on the ground after being first disturbed, and squatted under a low bush, trying, when wounded, to get refuge in a rat-hole" (Beavan).

I shot a solitary male in a field of growing wheat at Ambala on 16th February and believe that I saw one or two of this species on 25th November near Bilaspur.

874*. The Crested Lark—*Galerita cristata* (L.).

"Ambala, January 1866" (Beavan).

Common and probably resident; observed at Ambala, Morinda, Chandighar, Mubariqpur, and Mani Majra.

875*. Sykes' Crested Lark—*Galerita deva* (Sykes).

"Abundant at Ambala. I put up 3 or 4 of these birds out of low cultivation; their flight is somewhat hovering, like that of a *Mirafra*". (Beavan.)

879*. The Ashy-crowned Finch-lark—*Pyrrhulauda grisea* (Scop.).

Observed, sometime in flocks of a dozen individuals, on various dates between 3rd November and 25th March, at Ambala, Mubariqpur, Chandighar and Mani Majra. The bed of the Ghaggar river at the bases of the hills by Chandighar was a favourite locality.

895*. The Purple Sunbird—*Arachnecthra asiatica* (Lath.)

The distribution of this species in the Ambala District is interesting as illustrating how the district is divided in its affinities between the Punjab and the United Provinces. About Ambala itself the Purple Honeysucker is a most abundant summer resident, as in the case of the districts of the Punjab proper. It had already left when I arrived and returned about the 1st of March; its arrival was most marked as it became general and abundant in the space of a few days. On the other hand in the submontane area, such as Mubariqpur and Chandighar it was not uncommon throughout the winter, and far smaller numbers seemed to winter also about Morinda. Rupar and Bilaspur.

Beavan in recording this bird from Ambala District describes the winter plumage—the *Cinnyris currucaria* of Sykes which is erroneously stated in the Fauna of British India, Vol. ii, p. 359. to be a mark of age.

It breeds freely in the foothills between Kalka and Kasauli. its upper limit being roughly about the 5th milestone, but I did not meet it there in December.

921. The Thick-billed Flowerpecker—*Piprisoma squalidum* (Burt.).

A male of this curious and often overlooked little bird was shot by me at Mubariqpur on 20th February ; it appeared to be not uncommon in the mango groves of Morinda from the 18th to 20th March, and I observed a single bird in the District Board garden at Ambala on 1st April. This last had settled to roost for the night on a twig of a Cirrhus-tree under a sort of pent-house roof formed by two of the large flat seed cases of the tree, which were hanging from another twig.

969. The Brown-fronted Pied Woodpecker—*Dendrocopus auriceps* (Vig.)

A pair were haunting the neighbourhood of the Dak bungalow at Kasauli when I was there from 6th to 9th March.

972. The Yellow-fronted Pied Woodpecker—*Liopicus mahrattensis* (Lath.).

This Woodpecker was met with in small numbers and I found two nests with eggs. The first one was obtained on 28th March at Ambala and contained 3 slightly incubated eggs, the second was in a Kikur tree by the road past Bassi City and contained 3 slightly incubated eggs on 31st March.

986. The Golden-backed Woodpecker.—*Brachypternus aurantius* (L.).

Abundant and generally distributed.

1003. The Common Wryneck—*Iynx torquilla*, Linn.

Only two individuals were observed, one on the outskirts of Cantonments on 1st January and the other at Chandighar on 13th February. The latter was skulking in the bushes on one of the low hills in such a curious manner that I thought it was going to allow itself to be caught by hand.

1019. The Crimson-breasted Barbet—*Xantholæma hæmatocephala* (P. L. S. Muller).

Abundant and resident ; although an odd bird might be heard calling a little during the winter, their "tonk-tonk" did not become a familiar sound until after the middle of February. Eggs were found as follows:—19th March, c/3 fresh and c/2 fresh ; 28th March, c/3 moderately incubated. On one occasion I saw a Barbet excavating its nest-hole in a decayed bough ; it was holding on and hammering like a Woodpecker.

1022. The Indian Roller—*Coracias indica*, L.
Common and generally distributed.

1026.* The Common Indian Bee-eater—*Merops viridis*, Linn.
This common and generally distributed summer visitor was also noted in small numbers during the winter, a few birds wintering here and there in favoured spots. The advance guard started to arrive in February and by the middle of March the species seemed to have reached its full numbers. When at Kasauli in the second week of March I watched several flights working up from the valley up the hill past the Dak bungalow on different days and I presume that these were on migration.

1033*. The Indian Pied Kingfisher—*Ceryle varia*, Strickl.
Common and probably resident.

1035. The Common Kingfisher—*Alcedo ispida*, Linn.
Not uncommon in the submontane and well watered area about Chandighar and Mubariqpur during the winter: one was also seen at Chamkaur.

Beavan writes: "I procured a single specimen in November 1866 at Ambala, where, however, it is far from common."

1044*. The White-breasted Kingfisher—*Halcyon smyrnensis* (L.)
Common and probably resident.

1053. The Indo-Burmese Pied Hornbill—*Anthracoceros albirostris* (Shaw and Nodd).
In my Father's game-book there is a note about 'black and white Hornbills' found at Morni on 28th November 1886. This can only refer to this species which occurs in Dr. Scott's list under the locality Siwaliks.

1062. The Common Grey Hornbill—*Lophoceros birostris* (Scop.)
"At Amballa on 16th November 1866 I procured a specimen." (Beavan.)

Although not very common in Ambala itself this Hornbill was particularly abundant about Morinda, Kharali, Kharar, and in smaller numbers at Chandighar and Mubariqpur. It is doubtless a resident species.

Specimens obtained at Ambala are mentioned by the Marshalls (Stray Feathers, Vol. III., p. 331).

1066. The European Hoopoe—*Upupa epops*, Linn.
Detailed notes by Dr. David Scott, on the habits of Hoopoes at Ambala, will be found in the "Ibis" for 1866, p. 222, and 1867, p. 135. These notes are referred to and amplified by Dr. Jerdon in the "Ibis" for 1872, p. 21. I found the Hoopoe common and generally distributed throughout my stay in the district and took a nest with 3 eggs on April 4th. Owing to the war I have failed to have the skins collected critically examined, so provisionally accept Dr. Scott's identification, although I believe that the species represented is more likely to be *Upupa indica*.

1073. The Common Indian Swift—*Cypselus affinis*, Gray and Hardw.
A few were seen in November, and after that with the exception of a single bird on December 2, none were seen until February: they were common from the middle of that month until my departure. Numerous at Kasauli in March.

1082. The Himalayan Swiftlet—*Collocallia fusciphaga*, Thumb.

On 13th February I found a number of these Swifts flying low over the Ghaggar Nala at Chandighar just at the entrance to the hills.

1091.* The Common Indian Nightjar—*Caprimulgus asiaticus*, Lath.

On the nights of 25th and 26th March when in camp at Chandighar I heard the call of this Nightjar after dark, and I also heard it on the early morning of 26th March. The call imitates very exactly the sound made by a stone as it bumps rapidly over ice, when thrown along the surface.

1109. The Common Hawk Cuckoo—*Hierococcyx varius* (Vahl.)

I first heard this fine Cuckoo calling on 19th February, but did not hear it again until 1st March, after which date it seemed to become common and uttered freely both the "brain fever" note and the whirring ascending trill; on some occasions it was heard after dark. It occurred at Morinda, Rupar, Kharar, and Chandighar, in addition to Ambala.

1120. The Indian Koel—*Eudynamis honorata* (Linn.)

The first Koel of the summer was heard calling at Ambala on 11th April; and after that I heard a few more before my departure on 20th April, but up to that date the majority had clearly not arrived.

1129. The Sirkeer Cuckoo—*Taccocua leschenaulti*, Less.

I shot a female of this curious Cuckoo in the garden of the rest-house at Kharar on 20th December.

Beavan observes: "This species was apparently procured by the late Dr. Scott at Ambala, as it is included in the list of the birds sent thence by him to the Montrose Museum." *

One was shot by my Father at Kalka on 25th January 1887.

1130. The Common Coucal—*Centropus sinensis* (Steph.)

Generally distributed in small numbers and doubtless resident.

1135. The Large Indian Paroquet—*Palæornis nepalensis*, Hodgs.

With the exception of two individuals seen at Kharar on 24th March, I only observed this species at Chandighar; there I saw one or two flocks on 13th February and some odd birds on 26th and 27th March. Beavan states: "Noticed by the late Dr. Scott as abundant at Ambala in August 1867, but a merely temporary visitor at that Station, and apparently arriving there just after the young birds of the year are flown. Most specimens are then in bad plumage."

1138. The Rose-ringed Paroquet—*Palæornis torquatus* (Bodd.)

Beavan found this Paroquet to be "excessively abundant about gardens at Ambala in the cold weather, and in March I saw one or two pairs breeding there"—a description with which no later observer will quarrel. It is of course resident, and I doubt whether it ever reaches as high as Kasauli.

1139. The Western Blossom-headed Paroquet—*Palæornis cyanocephalus* (L.)

Not uncommon and generally distributed. Attention is usually drawn to this Paroquet by its call which is uttered in flight and is easily distinguishable from that of the last two species ; its smaller size and relatively longer tail tipped with yellow, and in the male the plum-coloured head, are also easily noticed in flight. It flies very rapidly and usually at a great height Odd birds may be found in flocks of *P. torquatus*, but where it is common separate flocks occur.

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* In the printed catalogue the only locality given is "Siwaliks."

1152. The Barn Owl—*Strix flammea*, L.

One or two pairs were observed to be living in the old and hollow trees of the ancient mango groves about the rest-house at Morinda when I was there on the 18th March.

1157*. The Short-eared Owl.—*Asio accipitrinus* (Pall.)

I did not meet with the Short-eared Owl, but Beavan states that he obtained a specimen at Ambala on 6th November 1866.

1158. The Himalayan Wood-owl—*Syrnium nivicola* (Hodgs.)

"Captain G. F. L. Marshall shot one at Kasauli, at a height of only 5,000 feet above the sea, and this is the lowest level at which I have known it to occur." (Hume's "My Scrapbook" p. 361.)

1161*. The Mottled Wood-owl—*Syrnium ocellatum*, Less.

Occurs in the Scott catalogue with the locality Ambala.

1164. The Brown Fish-owl—*Ketupa zeylonensis* (Gm.).

Beavan says :—" At Ambala, on 16th November 1866, I got a fine specimen in the late Dr. Scott's compound or garden. It was seated in a tamarisk tree......Dr. Scott told me that some 7 or 8 of this species had frequented his garden at Ambala the previous year (1865.)"

On 19th March I found two young Fish-owls, partly feathered but differing markedly in size, in a hollow a few inches deep in the trunk of an old mango tree at Morinda, in the garden where the Barn Owls were found. The old birds were to be heard calling at nights. Two other large Owls believed to be of this species were seen at Bilaspur on 28th November and Lalru on 14th February.

1168* The Rock-horned Owl—*Bubo bengalensis* (Frankl.).

Mentioned in Dr. Scott's catalogue with the locality Ambala.

1169* The Dusky-horned Owl—*Bubo coromandus* (Lath.).

Probably common and resident.

1173. The Scops Owl—*Scops giu* (Scop.)

A small Owl heard calling "brewer-brewer" at Morinda on 19th March was probably a Scops Owl. Hume mentions this species from Kasauli ('Scrap book,' p. 390).

1180. The Spotted Owlet—*Athene brama* (Temm.)

Beavan's remark that it is a very abundant species at Ambala leaves for me only to add that it is resident.

1189. The Osprey—*Pandion haliaëtus* (Linn.)

On 21st March while collecting on the sandbanks of the Sutlej river just above the Canal headworks at Rupar I fired at a passing Tern ; whereupon an Osprey which had been sitting on the sand further along got up and flew back over my head. I shot it and found that I had secured a fine female. The stomach was empty.

1190. The Cinereous Vulture—*Vultur monachus*, L.

"Appears regularly every cold weather at Ambala...... Colonel Tytler was lucky enough to secure a pair .... at Ambala in the cold weather of 1865-1866 (*See* Jour. A. S. B. 1866, p. 74)" (Beavan.) †

I observed it on the following occasions :—On 10th November at Chandighar, 9th December near Sirhind, 16th December at Rupar, and 31st December near Ambala.

1191* The Black Vulture—*Otogyps calvus* (Scop.)

Not uncommon; generally distributed and occurring as high as Kasauli, and probably resident. The greatest number that I saw at one time was five.

1192* The Griffon Vulture—*Gyps fulvus* (Gm.)

" In the plain country about Ambala it is particularly abundant at certain seasons. One I shot in the cold weather of 1865-66 at Sirhind." (Beavan.)

I oberved a few Griffon Vultures (though without being certain as to the exact species) during the winter, including one at Kasauli on March 8th. ‡

1195. The Himalayan Long-billed Vulture—*Gyps tenuirostris*, Hodgs.

In the Journal of the Bombay Natural History Society, Vol. XXIV, p. 358, Mr. A. E. Jones gives a full description of a nest of this species taken by him at Ambala in January 1915.

1196* The Indian White-backed Vulture—*Pseudogyps bengalensis* (Gm.)

This is the common and resident Vulture of the district, through which it occurs upto and including Kasauli. Numbers breed about Karali and Rupur in loose colonies in December some nests still contained young in the second half of March.

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† *Note.*—Captain Beavan's reference to Colonel Tytler's record is wrong ; the record is contained not in the "Journal of the Asiatic Society of Bengal" but in the "Proceedings" of that Society. The year and page are correct. The record is in the form of a letter, dated Ambala, 3rd March 1866 ; the following are the most important parts :—

"My dear Grote,

I have this moment or rather an hour ago shot a splendid specimen of that rare and noble bird the *Vultur monachus* .... I have always found the bird a very rare species ; the first I ever saw wild were two in the Punjab in November 1842...... I again fell in with a pair at Oorai near Cawnpore in December 1855 ...... I saw nothing more of them or any more till in December 1865 at Umballah when I was driving to the City from Cantonment and my son Frank, who was sitting beside me, drew my attention to two large Vultures surrounded by smaller Vultures on the carcase of a horse. We immediately drove up to the place, and again I saw this rare bird. There were three of them ..... a few days afterwards I saw three more flying in company with other Vultures ...... This morning, the 3rd March 1866, I had just returned from shooting when I found a note waiting for me from Dr. Scott, Medical Storekeeper, saying he had just seen two of these birds feeding with other vultures on the carcase of a horse, and described the place so well that although I was very tired I started at once for the spot. and then I had the satisfaction of again seeing the three of these noble Vultures" [one of which he shot].

‡ The list of the Scott Collection at Montrose includes *Gyps indicus* from Ambala. Without examination of the specimens, I cannot say what species is meant.

1198*. The Egyptian Vulture—*Neophron percnopterus* (L.).

"Especially abundant at Ambala where it breeds in March." (Beavan.)

I did not actually obtain any specimens of this common Vulture but am of opinion that it is this western form that occurs there and not the *N. gingianus* of Beavan's notes and the Scott Catalogue.

1199. The Bearded Vulture—*Gypaëtus barbatus* (L.).

Twice observed during my visit to Kasauli during the second week of March.

Beavan says: "I have seen it after dead cattle, in company with other Vultures, a few miles from Kalka, close to the foot of the hills; elevation perhaps 500 ft."

1201*. The Imperial Eagle—*Aquila heliaca*, Sav.

I saw an Eagle in lineated plumage at Chandighar on 13th February which was probably the young of this species. Beavan has a short note on *Aquila imperialis*: "I procured a fine specimen of this fine bird at Ambala on 30th November 1866 .... I believe that this species subsists about Ambala chiefly on Carrion," but it must be remembered that in his day the true Imperial Eagle and the Steppe Eagle had not been differentiated.

1203*. The Indian Tawny Eagle—*Aquila vindhiana*, Frankl.

Referring to this species under the name of *Aquila fulvescens* Beavan writes: "Common in the neighbourhood of Ambala" and gives details of 4 specimens obtained in the month of November.

I met with a fair number of these Eagles during the winter, but they appeared to be less common than in the northern Punjab and the sandy plains about Hissar.

1207. Bonelli's Eagle—*Hieraëtus fasciatus* (Vieill.)

Beavan states that he believes specimens were sent from Ambala by the late Dr. Scott to Lord Walden.

I shot at and wounded but unfortunately did not secure what I believe to have been a specimen of this Eagle on 25th March on the road between Kharar and Mani Majra; as it went away wounded, it was violently attacked by a pair of *Aquila vindhiana.* A pair at Morni on 28th November 1886 are mentioned in my Father's "Game book."

1208. The Booted Eagle—*Hieraëtus pennatus* (Gmel.)

"I believe that this Eagle occurs at Ambala and that I myself have seen it on more than one occasion in flight." (Beavan.)

1216. The Short-toed Eagle—*Circaëtus gallicus* (Gmel.).

One was observed on 6th November in the bed of the Ghaggar river near Mubariqpur, and a second at Bilaspur on 25th November.

1217. The Crested Serpent Eagle—*Spilornis cheela* (Lath.).

I saw one of these handsome Serpent Eagles on 10th November, in the Ghaggar Nala, where it debouches from the low hills above Chandighar.

1220*. The White-eyed Buzzard Eagle—*Butastur teesa* (Frankl.).

"Tolerably abundant about Ambala, in the station of which I got my first specimen on 23rd October 1866, and afterwards procured several others" thus Beavan, who also mentions obtaining a male and female at Lallroo on 14th November.

Met with in small numbers throughout the winter.

1223 Pallas' Fishing Eagle—*Haliaëtus leucoryphus* (Pall.).

Observed on the Ghaggar at Mubariqpur on 19th February, and at Rupar on 20th March. I also found a pair nesting in a large Peepul tree at Rupar on the 18th December, and ascertained that the nest contained two eggs, one addled, and one hard-set.

1228 The Brahminy Kite—*Haliastur indus* (Bodd.).

I saw what was perhaps an immature specimen of this kite about the Canal headworks at Rupar on 20th March.

1229* The Common Pariah Kite—*Milvus govinda*, Sykes.

Abundant and resident occurring as high as Kasauli. Pairing started in January and February and there were eggs in the majority of nests by the end of the latter month. Beavan merely states that the Kite is less common at Ambala than in Bengal.

1232*. The Black-winged Kite—*Elanus cœruleus* (Desf.).

Although Beavan says "They were particularly abundant in the jungles to the south of Ambala in November 1866, and might frequently be seen hovering like a Kestrel......a freshly killed specimen at Babyn, near Ambala," I only observed a single example. This was near Jagadri on 30th November.

1233*. The Pale Harrier—*Circus macrurus* (S. G. Gmel.).

A few Harriers seen on different dates between 2nd November and 25th March were attributed to this species, but no specimens were collected.

1237. The Marsh Harrier—*Circus æruginosus* (L.).

A winter visitor in fair numbers; it was common in the Chamkaur marsh when I was there on 13th and 14th December, but was also generally distributed in the district.

1239*. The Long-legged Buzzard—*Buteo ferox* (S. G. Gmel.).

"I killed a fine specimen of the female of this species at Ambala on November 5th, 1866". (Beavan.)

A winter visitor; a few were met with on various dates between 13th November and 4th March, almost all of the dark form. A live specimen was brought to me which I kept for about a week and then released; it seemed fairly gentle and tame in disposition.

1244. The Shikra—*Astur badius* (Gmel.).

Common, generally dispersed and resident. I saw what wa either this or the next species up in Kasauli in the secon week of March.

1247. The Sparrow-hawk—*Accipiter nisus* (Linn.).

A winter visitor in small numbers; observed on a few occasions in November and December. I observed one soaring over a valley on the road upto Kasauli on 5th March.

1248. The Besra Sparrow-hawk—*Accipiter virgatus* (Reinw.).

An old female obtained at Ambala is mentioned by Hume in his "Scrap book," p. 135.

1249*. The Crested Honey Buzzard—*Pernis cristatus* (Cuv.).

Observed on the following occasions:—27th October, 16th November and 19th November, at Ambala; 20th March near Karali; and 25th March between Kharar and Mani Majra. The bird observed on 16th November, came up with one or two kites and so interfered with my trained Falcons that were being exercised to the lure that I had to shoot it; when I picked the corpse up, honey was dripping from the mouth. The bird of 19th November was also attracted by my Falcons.

1254. The Peregrine Falcon—*Falco peregrinus*, Tunst.

An immature Peregrine was observed in the neighbourhood of my house on 12th November and seen about frequently until 3rd December when I shot it for my collection, as my Falconer was unable to net it. Unfortunately the organs were most indistinct and I was unable to decide whether it was a very big male or a very small female. Until it was shot my Falconer had believed it to be a Shahin.

Hume in his "Scrap book" at part I, p. 50, mentions an adult tiercel killed at Ambala.

1257.* The Lugger Falcon—*Falco jugger*, Gray.

Common and resident, and generally distributed. On 25th March near Mani Majra I found a female sitting in an old nest of *Pseudogyps* on a large gaunt Peepul tree. She was persuaded to leave the nest with difficulty, and on examination I found that it contained two young in down and an addled egg. The young birds differed in size and age.

1258. The Saker Falcon—*Falco cherrug*, Gray.

Hume in his "Scrap book" (p. 62) says: "It has been repeatedly shot, as low down as Ambala and even Delhi."

1259. The Shanghar Falcon—*Falco milvipes*, Hodgs.

In the "Ibis" for 1871, p. 240, there is the following note under the heading of *Falco sacer*:—"I cannot keep suspecting that another species of Falcon is often confounded with the true *F. sacer*. I first heard of this bird from Col. Delmé-Radcliffe, who wrote me that he had once seen a large Falcon like the Cherrug, but with the upper plumage somewhat banded and Kestrel-like. The late Dr. Scott obtained a specimen (which was shot at Ambala) of a female Falcon which closely tallies with this notice; and Lord Walden now possesses this specimen, which I saw and took note of at Dr. Scott's." Its description follows, and this note is referred to in the synonomy of *Falco milvipes* in the Fauna of B. I. Birds, Vol. iii, p. 421.

1264.* The Red-headed Merlin—*Æsalon chicquera* (Daud.).

"Ambala, November 5th, 1866; Shot the male out of a pair which were alternately stooping on the race course at a small lark Pipit." (Beavan.)

Resident and not uncommon. One evening while shooting Snipe in a reed-bed at Chamkaur I disturbed a *Lusciniola melanopagon* which was all but taken by a Jack Merlin which stooped close past my head from behind me. On another occasion near Rupar (on 18th December) I saw a clever but unsuccessful piece of teamwork by a pair of these Merlins. A number of Doves had taken refuge in a Kikur tree, and while one bird waited on above the tree ready to stoop the other tried hard to drive the Doves out to it; but the Doves refused to leave their thorny refuge.

1265.* The Kestrel—*Tinnunculus alaudarius* (Gmel.).

A not uncommon winter visitor to the plains. I saw one at Kasauli on 9th March and three together there on 10th March one was seen in the low hills above Kalka at the end of December.

Beavan mention obtaining a specimen at Ambala in November, 1866.

1266. The Lesser Kestrel—*Tinnunculus cenchris* (Naum.).
Hume in his "Scrap book" part I, p. 105, states "I have seen a specimen killed near Ambala" and this record is referred to in "Stray Feathers," Vol. iii, p. 384.

1271. The Bengali Green Pigeon—*Crocopus phœnicopterus* (Lath.).
"This species also occurs sometimes about Ambala, according to the late Dr. Scott." (Beavan.)

1272. The Southern Green Pigeon—*Crocopus chlorogaster* (Blyth.)
I observed flocks of this handsome Pigeon about an avenue of Peepul and Bhur trees at Morinda about the 10th December and the 15th March; on the second occasion their numbers had perhaps diminished. A few were noted at Karali on 20th March, and several about the District Board garden at Ambala towards the end of March and the beginning of April.

1292. The Indian Blue Rock Pigeon—*Columba intermedia,* Strickl.
Abundant and generally distributed.

1295. The Eastern Stock Dove— *Columba eversmanni,* Bonap.
Beavan's note on this is as follows:—"I believe it was first discriminated at Ambala by my late valued friend Dr. Scott, who had previously resided for some time at Hansi, and told me that he had seen them at the latter station in the first instance, and then informed either Dr. Jerdon or Mr. Blyth of their nearly annual occurrence also at Ambala. Indeed, although during my stay there in 1866 none were to be seen some, I believe, had been killed there the year before, and Dr. Scott promised to look out again anxiously for their arrival and let me know. But unfortunately he succumbed to the climate." I saw a flock at Ambala on 15th November, and perhaps another party at Chandighar on 26th March.

1305. The Indian Turtle Dove—*Turtur ferrago* (Eversm.)
Only met with at Bilaspur, from 25th to 29th November. There in the evenings I found some frequenting a line of tall Shisham trees planted along the sides of a Mango tope; they were very shy and perched high up, and I had some difficulty in securing a couple of specimens.

1307.* The Spotted Dove—*Turtur suratensis* (Gm.)
"It is found throughout the country upto Ambala." (Beavan.) The status of this Dove in Ambala district is not quite clear but I found it common at Chandighar in November, February and at the end of March. It was common about Ambala in February and April and common at Bilaspur at the end of November. I shot one there on November 30th.

1309. The Little Brown Dove—*Turtur cambaiensis* (Gm.)
Beavan says: "I observed it rarely at Ambala in 1866. I found it abundant throughout the winter." In December it was the only species of dove observed at Kalka.

1310. The Indian Ring Dove—*Turtur risorius* (Linn.)
Common but seemed to decrease in numbers during January, February and March.

1311.* The Red Turtle Dove—*Œnopopelia tranquebarica* (Herm.)

"I have observed it....at Ambala, where it is decidedly rare" (Beavan.) Although in the Northern and Central Punjab this dove appears to be a summer resident only I have found it in small numbers throughout the winter with the exception of January when I failed to note it. The numbers increased about the end of March and I first heard the courting note on the 29th of that month.

1316* The Imperial Sandgrouse—*Pterocles arenarius* (Pall.)

" Found in some numbers about Ambala about certain seasons. But when I was there (November 1886), they had not arrived". (Beavan.)

Found to be common about Chamkaur from the 12th to the 14th of December, where great numbers were observed coming to a drinking place in the marsh in the early morning and flocks were found about the fieds in the evening.

1317. The Painted Sandgrouse—*Pterocles fasciatus* (Scop.)

After dusk on 10th November, when I was passing down the Ghaggar Nala towards Chandighar, two birds settled at the edge of the water amongst the stones to drink. Not being able to see what they were, I shot one and found that I had secured a female Painted Sandgrouse.

Beavan states: " The late Dr. Scott received a pair killed within 20 miles of Ambala from a native shikari, and writing under date August 2, 1867, says :—This is the first time I have heard of this species occurring in the neighbourhood of Ambala."

In my Father's "Gamebook" under 26th January 1887 appear a couple of Painted Sandgrouse shot from a flock below Kalka.

1321.* The Common Sandgrouse—*Pteroclurus exustus* (Temm.)

" Abundant about Ambala. . . . In the cold weather . . . a male killed at Ambala on 16th November 1866." (Beavan.)

Met with not uncommonly during the winter at Mubariqpur, Rupar, Chamkaur and Chandighar. Obtained by my Father near Kalka.

1324.* The Common Peafowl—*Pavo cristatus*, Linn.

Common and resident throughout the district. They are very abundant in the low hill jungles about Chandighar and Kalka where they fly well and without hesitation, affording some shots worth taking. The local villages have no objection to their being killed and are said even to eat them themselves.

1328. The Red Jungle Fowl—*Gallus ferrugineus* (L.)

"Far from uncommon . . . . under the hills near Ambala in 1866, whence I procured a pair in the November of that year". (Beavan.)

The Jungle Fowl was very numerous in the low hills to the N.-E. of Chandighar when I was there on 10th November and a few were met with close to Kalka on 28th December.

I also heard of it as being very common about Morni, and indeed I believe it occurs all along the hills to their eastern limit in the district, but I had no opportunity of verifying the fact for myself.

1336. The White-crested Kalij Pheasant—*Gennæus albicristatus* (Vig.)

It appears from a note, dated 5th December 1886, in my Father's "Gamebook" that he then met with a few of these pheasants at Morni. I am not aware whether it still occurs there or not.

1355.* The Common or Grey Quail—*Coturnix communis*, Bonnaterre.

"Near Ambala they afford very good sport with a dog." (Beavan.)

I observed 10 individuals in all on various dates during the winter; it must however be abundant on passage as in other districts.

1357. The Jungle Bush-quail—*Perdicula asiatica* (Lath.)

On November 10th and February 13th when after Jungle Fowl in the low hills to the N.-E. of Chandighar I met with a few coveys of this curious little Quail and obtained some specimens. The coveys consisted of some 8 or 10 birds apiece and were found in thick cover towards the base of the hills along the edge of cultivation.

Beavan notes that "it occurs in the jungles about Ambala".

1372. The Black Partridge—*Francolinus vulgaris*, Steph.

Met with but not very abundantly at Mubariqpur, Bilaspur and Chamkaur. Beavan merely mentions obtaining it at Ambala in 1865.

1375.* The Grey Partridge—*Francolinus pondicerianus* (Gm.)

Common and generally distributed, occurring in some numbers in the low hill jungles about Kalka and Chandighar on the same ground as Jungle Fowl.

1383.* The Little Button-quail—*Turnix dussumieri* (Temm.)

"The late Dr. Scott, who sent specimens to the Montrose Natural History Society, records this species from Ambala". (Beavan.)

1388. The Water-Rail—*Rallus aquaticus*, Linn.

On 14th December I secured a male at Chamkaur, one of a couple that were feeding at dusk on the edge of a flooded patch of sugarcane. The stomach contained small fresh watersnails complete in their shells.

1401. The White-breasted Waterhen—*Amaurornis phœnicurus* (Penn.)

A blackish Ralline bird with a whitish face or neck seen at Mubariqpur on 20th February was probably of this species, with which I am otherwise unacquainted.

1402. The Moorhen—*Gallinula chloropus* (L.)

Only met with in the marshes near Mubariqpur were one was seen on 6th November and two more on 20th February.

1405. The Coot—*Fulica atra*, L.

Beavan records a specimen at Ambala on November 3rd 1866 . . . . "I have seen this species in the tanks at Ambala in the 'Phulbagh' ". I met with a few near Mubariqpur on 6th November, and at Kharar on 24th March.

1409. The Sarus Crane—*Grus antigone* (L.)

In spite of Beavan's statement that the Sarus Crane is "very common in some parts of India, more especially in the neighbourhood of Ambala" I only met with two pairs, one between Ambala and Jagadri in November, the other at Chamkaur in December.

1418.* The Stone Curlew—*Œdicnemus scolopax* (S. G. Gmel.)

On 19th March I found a solitary egg laid under a mango tree in one of the topes at Morinda; this find has been described at length elsewhere (*cf.* "Bird Notes" May 1916). My Falconer had reported seeing 4 birds in the same locality on December 8th: also early in April a call that I attributed to this species was heard about my bungalow in Ambala.

1419. The Great Stone Plover—*Esacus recurvirostris* (Cuv.)

Several were observed on the sandbanks of the river Sutlej above the Canal headworks at Rupar on 20—21st March, and on the latter date I found a nest with 2 fresh eggs.

1422.* The Indian Courser—*Cursorius coromandelicus* (Gm.)

"Of this species I procured a pair at Lallroo, near Ambala, on the 14th November 1866........the species is not uncommon in the cold weather at Ambala, frequenting chiefly ploughed land in small flocks." (Beavan.)

4 Coursers seen on the short sandy turf of the Ghaggar Nala at Mubariqpur on 20th February were perhaps of this species.

This species occurs in the list of the Scott Collection with the addition of the words "Ambala. Not very common."

1423. The Cream-coloured Courser—*Cursorius gallicus* (Gm.).

A party of 3 Coursers seen in a ploughed field near Bilaspur on 30th November appeared to be of this species.

1427. The Small Indian Pratincole—*Glareola lactea*, Temm.

A single specimen was observed hawking about the Ghaggar Nalla at Mubariqpur on 19th February; on 24th March at Kharar I observed a small party flighting towards the river Sutlej at dusk.

1429.* The Pheasant-tailed Jacana—*Hydrophasianus chirurgus* (Scop.)

Occurs in Dr. Scott's list.

1431.* The Red-wattled Lapwing—*Sarcogrammus indicus* (Bodd.)

Common and generally distributed, but probably partly migratory as I met with a flock of about a dozen on the river at Rupar on 21st March, which were probably migrating birds.

1433.* The Yellow-wattled Lapwing—*Sarciophorus malabaricus* (Bodd.)

"Procured......at Ambala, November 14, 1866." (Beavan.)

1435. The Indian Spurwing Plover—*Hoplopterus ventralis* (Wagl.)

I had not previously met with this Plover in the Punjab until, when staying at Rupar on 20—22nd March, I found it common on the sandbanks of the Sutlej above the Canal headworks. Those met with were not particularly shy and appeared to be breeding although I could find no nests. However, one shot, had a large egg in the ovary. They were found in pairs skulking about at the water's edge on the sandbanks; in appearance, save for the absence of wattles, they would be very like the last species, but their manner is very different. They skulk and run in a most characteristic and shame-faced manner, with the body rigid and parallel with the ground, and the head sunk into the shoulders as if there were no neck.

1436. The Lapwing—*Vanellus vulgaris*, Bechst.

This common winter visitor was met with at Mubariqpur, Chandighar, Chamkaur and Ambala, on various dates between 6th November and 20th February.

1437* The Sociable Lapwing—*Chettusia gregaria* (Pall.)

"A specimen was killed by me at Lallroo near Ambala on the 14th November 1866; and this species is mentioned by the late Dr. Scott who sent specimens from Ambala to the Montrose Museum." (Beavan.)

I saw three at Mubariqpur on 6th November and a flock near Morinda on 11th December.

1438. The White-tailed Lapwing—*Chettusia leucura* (Licht.)

"A specimen now in Col. Tytler's collection was procured by the late Dr. Scott at Babyn near Ambala in 1866." (Beavan.)

Common in small parties about the marshes at Chamkaur on 13th and 14th December. A flock of about a dozen was seen in the Mubariqpur marshes on 20th February.

1439. The Eastern Golden Plover—*Charadrius fulvus*, Gm.

"It is occasionally, I hear, found near Ambala." (Beavan.)

1446. The Kentish Plover—*Ægialitis alexandrina* (L.)

Two were observed on 3rd November at Mubariqpur in the Ghaggar Nala and a party of 4 were seen on a sandbank of the Sutlej river at Rupar on 20th March.

1447* The Little Ringed Plover—*Ægialitis dubia* (Scop.)

"I shot a pair out of a small flock which were feeding along the edge of a small tank near the Native Infantry lines at Ambala in January 1866." (Beavan.)

A few were observed mostly in pairs about the sandy and stone-strewn flats of the Ghaggar at Mubariqpur when I was there from 3rd to 7th November, and on 19th and 20th February. Single individuals were seen at Rupar on the Sutlej on 16th December and 21st March.

1451* The Black-winged Stilt—*Himantopus candidus*, Bonn.

"Noted by the late Dr. Scott as having been procured by him at Ambala and specimens sent to the Natural History Society of Montrose." (Beavan.)

One was seen by me at Karali on 20th March.

1454. The Curlew—*Numenius arquata* (L.)

I did not meet with this species myself but Mr. R. B. Whitehead, I.C.S., Settlement Officer, informed me that he saw one below Chamkaur on 19th January, and 4 more in the same locality on 21st January.

1460*. The Common Sandpiper—*Totanus hypoleucus* (L.)

A few only were observed, on various dates between 23rd October and 20th March. Beavan mentions a specimen killed at Ambala on 30th October 1866.

1461*. The Wood Sandpiper—*Totanus glareola* (Gm.)

A few were seen on migration at the Kharar tank on 24th March.

1462. The Green Sandpiper—*Totanus ochropus* (L.)

"I have shot it several times....at Umballa, whence I have noted a specimen which was killed on 30th October 1866." (Beavan.)

Found commonly throughout the winter and last seen on 9th April.

1463. The Marsh Sandpiper.—*Totanus stagnatilis*, Bechst.

I saw what I believe to have been one of these Sandpipers at the Kharar tank on 24th March.

1464. The Redshank—*Totanus calidris* (L.)

A few were observed at Chamkaur on 13th December, from the train between Ambala and Rajpura on 27th January and at Rupar on 20th March.

1466*. The Greenshank—*Totanus glottis* (L.)

"Noted by the late Dr. Scott as having been procured by him at Ambala, and the specimens sent to the Natural History Society of Montrose." (Beavan.)

A common winter visitor and probably the most abundant species of Sandpiper after the Green Sandpiper. It is usually met singly but on migration parties occur; for instance I saw a flock of 9 on the river Ghaggar at Mubariqpur on November 6th and a flock of 15 to 20 individuals on the Sutlej at Rupar on 21st March.

1471 and 1474. Stints.—*Tringa minuta*, Leisler and *T. temmincki*, Leisler.

A few odd Stints were seen during the winter from December to 24th March; but as I obtained no specimens I was unable to identify the species represented.

1484*. The Common Snipe—*Gallinago cœlestis* (Fronzel.)

The Common Snipe is of course a winter visitor and a passage migrant only to Ambala district and there are one or two jheels—notably at Mubariqpur and Chamkaur—where sport may be obtained. I did not see any later than 24th March when I flushed about a dozen from the weedy margins of the tank at Kharar.

1487. The Jack Snipe—*Gallinago gallinula* (L.)

Many were found in the Chamkaur jheel on 14th December; and a few in the Mubariqpur marshes on 20th February. One was flushed at the Kharar tank on 24th March.

1490. The Laughing Gull—*Larus ridibundus*, L.

Six or seven Gulls were seen on the Sutlej river at Rupar on 16th December and 2 more on 20th March; two others were seen on the Ghaggar at Mubariqpur on 20th February. All were probably of this species.

1499. The Gull-billed Tern—*Sterna anglica*, Mont.

On 20th February on the Ghaggar at Mubariqpur I saw a curious-looking Tern with a black bill; it was perhaps a Gull-billed Tern in transition plumage.

1503. The Indian River Tern—*Sterna seena*, Sykes.

Common and resident; it breeds in colonies in April on the sandbanks of the river Sutlej above the Canal headworks at Rupar. Recorded by Beavan without remark.

1504. The Black-billed Tern—*Sterna melanogaster*, Temm.

Common and probably resident, but less abundant on the whole than the last species. While I was at Mubariqpur early in November large flights used to pass down the Ghaggar at dusk, but this habit seem to have practically stopped when I was there again in February.

1517. The Indian Skimmer—*Rhynchops albicollis*, Swains.

Observed to be fairly common about the sandbanks of the river Sutlej above the Canal headworks at Rupar in the second half of March. It was doubtless intending to breed there with the colonies of *Sterna seena.*

1526. The Common Cormorant—*Phalacrocorax carbo.* (L.)

With the exception of a single individual seen at the Kharar tank on 24th March, I only met with Cormorants at Rupar, when I visited that place in December and March. There they were numerous and were frequently observed fishing in the pools connected with the Canal Dam across the Sutlej.

1528*. The Little Cormorant—*Phalacrocorax javanicus* (Horsf.)

Included in Dr. Scott's list.

1542. The Black Ibis—*Inocotis papillosus* (Temm.)

A flock of about a dozen Ibis was observed in the Ghaggar Nala at Chandighar on 13th February, and a similar flock in the marshes at Mubariqpur on 20th February. Single birds were seen at Morinda on 11th December, and near Ambala on 15th February.

1545. The Spoonbill—*Platalea leucorodia,* Linn.

A flock of large white birds seen in the distance on the sands of the Ghaggar at Mubariqpur on 20th February appeared to be composed of Spoonbills.

1546. The White Stork—*Ciconia alba,* Bechst.

Only observed at Morinda where I saw one on 9th December, and a party of six on 12th December.

1548. The White-necked Stork—*Dissura episcopus* (Bodd.)

Observed not uncommonly throughout the winter on various dates between 7th November and 26th March ; it seemed to be fairly generally distributed, but was most frequently observed about the stony bed of the Ghaggar river where it emerges from the low hills at Chandighar: here it was frequently gathered in flocks.

1549. The Black-necked Stork—*Xenorhynchus asiaticus* (Lath.)

On the evening of 3rd November at Mubariqpur I saw a flock of 50 to 60 Storks (which I attributed to this species) arrive flying high from an easterly direction, and after much circling proceed to settle in the bed of the Ghaggar ; only some half dozen individuals had touched the ground when without apparent reason the flock rose again to a great pitch and returned whence it had come ; on the evening of 6th November but about two miles from that place I saw a party of the same Storks flying in a westerly direction, as if going to roost.

Some were seen from the train between Ambala and Jagadri on 24th November. Storks attributed to this species were seen on the hills at Rupar on 16th December and 20th March, at Kharar on 24th March and at Chandighar on 25th March.

1554. The Eastern Purple Heron—*Ardea manillensis* (Sharpe).

This Heron was observed to be fairly numerous about the marshes and water-channels of Mubariqpur where I was there on 6th November and 20th February ; a few were flushed from the reed-beds but the majority were found sitting on the tops of trees where the long necks gave them a very curious appearance. Elsewhere only two were seen, at Chamkaur on 14th December.

1555. The Common Heron—*Ardea cinerea,* Linn.

"Occurs about Ambala, as I learned from the late Dr. Scott." (Beavan.)

Observed here and there throughout the winter, whether on the river or at the side of the smallest village pond.

1559. The Large Egret—*Herodias alba* (L.)

Two were seen at Chamkaur on 14th December.

1562*. The Cattle Egret—*Bubulcus coromandus* (Bodd.)

A number were observed about Chamkaur from 12 to 14th December.

1565*. The Pond Heron—*Ardeola grayi* (Sykes).

I do not understand the distribution of this common bird in Ambala district. While none were met about the marshes of Chamkaur on 14th December many were observed from the train near Lalru on 27th December and between Rajpura and Ambala on 26th January. After this the only ones observed were as follows:—24th March, 2 at Kharar; 27th March, 1 at Chandighar; 12th April, 1 at Ambala.

1568*. The Night Heron—*Nycticorax griseus* (L.)

Included in Dr. Scott's list.

1574. The Bittern—*Botaurus stellaris* (L.).

One was observed about some thick reed beds at Chamkaur on the 13th and 14th December, and two were flushed from reeds in the Mubariqpur marshes on 20th February.

1579. The Grey-lag Goose—*Anser ferus*, Schaeff.

"Tolerably common about Ambala in the cold weather, especially so in January 1866, when I tried to stalk some but signally failed. I find that the late Dr Scott remarks of this species that on the 3rd and 4th March 1866, vast flocks were seen passing over Ambala, leaving for the colder lakes of Tibet. In the preceding year (1865), the rain which fell at the end of February and the beginning of March caused them to leave later in the annual migrations; and he mentions that on the 7th March he saw 2 flights of Geese. and on the 8th and 9th of the same month 'more ditto'; while on the 14th March 1865, only a small flight were to be seen high in the air over the race-course. In 1864, he notices having seen wild Geese passing north on the 28th and 29th of February, and in 1863 the dates were respectively February 27th and 28th of Geese leaving the plains." (Beavan.)

1583. The Bar-headed Goose—*Anser indicus* (Lath.)

"They occur in large numbers around Ambala and are captured by the natives". (Beavan.)

I saw a big gaggle of Geese, apparently of this species, about the Sutlej at Rupar on 20th and 22nd March.

On 18th November and 21st February, I heard what appeared to be gaggles of Geese passing over my bungalow in Ambala after dark, and on the 5th March about 9 a.m. I saw what appeared to be some Geese flying *southwards* in the same place. It was of course impossible to say what species was represented.

1586. The Pink-headed Duck—*Rhodonessa caryophyllacea* (Lath.)

I have already recorded (Journal, B. N. H. S., xxiv., 599) a pair of these rare Ducks which I saw at Rupar on 21st March.

1588. The Ruddy Sheldrake—*Casarca rutila* (Pall.)

Common in the marshes of Chamkaur on 13th and 14th December, and on the Sutlej above Rupar on 16th December and from the 20th to the 22nd of March. A single individual was observed flying over Civil Lines on 1st December.

1592. The Mallard—*Anas boschas*, Linn.

"Common about Ambala in the cold weather." (Beavan.)

There appeared to be a few about the marshes of Chamkaur, and many on the river about Rupar about the middle of December. Some numbers were reported to be visiting the marshes of Mubariqpur early in February, but I only found three when I went after them on 20th February.

Two appear in my Father's "Gamebook" as shot at Morni on 5th December 1886.

1595. The Gadwall—*Chaulelasmus streperus* (L)

One was shot by my Father at Morni on 2nd December 1886.

1597.* The Common Teal—*Nettium crecca* (L.)

"Common about Ambala." (Beavan.)

Met with in small numbers during the winter and last seen on 24th March.

1599. The Wigeon—*Mareca penelope* (L.)

"Common about Ambala." (Beavan.)

1600. The Pintail—*Dafila acuta* (L.)

"Abundant about Ambala." (Beavan.)

I saw some on the river at Rupar on 21st March, and perhaps a party at Chamkaur on 13th December.

1601. The Garganey—*Querquedula circia* (L.)

A number were found in a weedy tank at Kharar on 24th March.

1602.* The Shoveller—*Spatula clypeata* (L.)

"Shot near Ambala in January 1866, where it is also recorded by the late Dr. Scott as having been sent by him to the Montrose Museum." (Beavan.)

Some were observed on the river at Rupar on 21st March, and about a dozen in the tank at Kharar on 24th March.

1605. The Pochard—*Nyroca ferina* (L.)

Some half dozen were found in the tank at Kharar on 24th March.

1609. The Tufted Duck—*Nyroca fuligula* (L.)

Several were met with by my Father at Morni in November 1886.

1617. The Indian Little Grebe—*Podicipes albipennis* (Sharpe.)

Some were seen in the tank at Kharar on 24th March.

THE CYPERACEÆ OF THE BOMBAY PRESIDENCY.

BY

L. J. SEDGWICK, F.L.S., I.C.S.

Part II.

(Continued from page 700 of Volume XXV.)

4. **Courtoisia,** *Nees.*

See Clavis (Species 2, India, Africa, Madagascar.)

1. **C. Cyperoides,** *Nees.* A medium-sized yellowish herb, with long leaves. Umbel usually compound. Bracts long, far overtopping the inflorescence. Bracteoles short. Spikelets in dense globose heads, $\frac{3}{8}$ in. wide, ovoid, usually 1-flowered. Nut $\frac{1}{8}$ in. long or longer, very narrowly fusiform; acutely trigonous or almost winged, brown.

In water holes in the southern parts of the Presidency; not uncommon in the Mallad tract of the Carnatic. (India N. E. and S. W. Trop. Africa, Madagascar).

5. **Fimbristylis,** *Vahl.*

Annuals or perennials. Root system various, but seldom if ever stoloniferous. Stems usually tufted. Leaves basal, v. rarely reduced. Inflorescence either a single spikelet, or a head of spikelets, or of umbellately disposed solitary or clustered spikelets. Spikelets terete or polygonal, many-flowered, usually glabrous. Rhachilla persistent. Glumes deciduous 2-sexual except sometimes the few (empty) at the base or apex of the spikelet. Hypogynous bristles or scales O. Stamens 1—3. Style either bifid in which case usually flattened, or trifid in which case usually filiform, often pubescent or villous, deciduous with the usually dilated base. Nut usually stipitate on a gynophore, biconvex in the forms with bifid, trigonous in the forms with the trifid styles. (Species about 125—all warm regions, but especially S. E. Asia and N. Australia.)

Very closely allied to *Scirpus* and *Eleocharis,* but without hypogynous bristles. The various species do not show any great uniformity of inflorescence. I have followed Clarke's division of the genus, rather than including with *monostachya* the specie *complanata* and *junciformis,* since the distichous lower glumes of those species are not very apparent, and their habit is with sub-genus *trichelostylis.* I have placed the sub-genus *ABILDGAARDIA* at the head of the genus, since the distichous lowest glumes, so far as this feature is not due merely to insufficient development of the rhachilla in its basal portion, would connect with the *Cypereæ.*

Section I. (ABILDGAARDIA) *Lower glumes of the spikelet distichous or sub-distichous. Style 3-fid.*

1. **F. monostachya,** *Hassk.* 6-12 inches high. Leaves crowded at the base of the stem and shorter than it, filiform, wiry.

Spikelets usually solitary, sometimes with a second above the first, $\frac{1}{4}$—$\frac{1}{2} \times \frac{1}{6}$—$\frac{1}{4}$ in., compressed, ovate, acute, shining, white or v. pale straw-coloured, the two lowest glumes usually longer than the others, cuspidate, the lowest sometimes increased to a bract. Glumes loosely imbricate, distichous below, 2—3-stichous above, acute, cuspidate. Nut large pyriform with a stalk-like base but not a true stipe, very obtusely trigonous, smoothly warted, pale.

A sedge of rather dry grassy places ; throughout the Presidency. (Most warm countries).

Section II. (ELEOCHAROIDES) *Stem with one spikelet. Glumes not distichous.* (Occasional examples with 2-3 spikelets occur. See also *F. schœnoides*).

Key to the section :—

1. Nut narrowly elongate, cylindric, curved .. 2. *F. tetragona.*
2. Nut obovoid, biconvex, with 6-8 very deep transverse corrugations .. .. .. 3. *F. acuminata.*
3. Nut elegantly obovoid with almost obcordate apex, biconvex, minutely sub-tuberculately dotted .. .. 4. *F. polytrichoides.*

2. **F. tetragona,** *R. Br.* 6-24 inches. Leafless or nearly so. Spikelets not subtended by bracts, or rarely with the lowest glume slightly enlarged, obconic, densely many-flowered, $\frac{1}{4}$—$\frac{1}{2}$ in., usually rather dark. Glumes elongate, obtuse, incurved round the nut. Nut as clavis, obscurely 9-ribbed and trabeculate.

A gregarious sedge of marshes and pools. Common throughout the Presidency, except North Gujarat. (Indo-Malayan.)

3. **F. acuminata,** *Vahl.* Tufted, 4-8 in. Leaves reduced to sheaths, the uppermost of which has sometimes a slight process. Stems slender with one lanceolate acute few-flowered spikelet. Glumes ovate subacute with a very strong midnerve. Nut as clavis, pale, margined. The nut is v. distinctive.

Very rare. Yellapur, N. Kanara (Herb Talb.) (Indo-Malayan).

4. **F. polytrichoides,** *Vahl.* Tufted 2-9 inches with slender stems and filiform leaves. Spikelets solitary, very rarely more, usually ebracteate, sometimes with a filiform erect bract like a continuation of the stem, ellipsoid, acute (in the Bombay example). Glumes many, secund, appressed, obtuse or sub-obtuse. Nut as clavis.

Rare. Sion, Bombay ; Karwar. (Indo-Malayan. A maritime species).

Section III. (DICHELOSTYLIS)—*Spikelets more than one. Style bifid. Ovary and fruit compressed, biconvex.*

Key to the Section :—

A. Spikelets 1-3, rarely up to 5, large, ovate, pale, glistening .. .. 5. *F. schœnoides.*

B. Spikelets more than 5 in fully grown individuals.

1. Spikelets in a capitate head .. .. 6. *F. argentea.*
2. Spikelets umbelled.

(*a*) Small tufted annuals.
  (i) Nut smooth .. .. 7. *F. æstivalis.*
  (ii) Nut ribbed and trabeculate .. 8. *F. dichotoma.*
(*b*) Taller.
  (i) Glumes obtuse with hyaline margins and tips ; nut dark, not ribbed or trabeculate .. .. .. 9. *F. spathacea.*
  (ii) Glumes mucronulate, glabrous ; nut pale, ribbed and trabeculate .. 10. *F. diphylla.*
  (iii) Spikelets large, dark red-brown ; glumes usually pubescent in upper half, nut pale, smooth .. 11. *F. ferruginea.*

5. **F. schoenoides,** *Vahl.* Glabrous, 5-20 inches, tufted. With very slender stems and filiform wiry leaves. Inflorescence either a solitary spikelet, or 2-5, distantly arranged. Lowest glumes subbractiform or definitely developed into bracts. Spikelets $\frac{1}{3} \times \frac{1}{4}$ in., broadly ovoid, glossy, pale. Glumes loosely imbricate almost hemispheric, obtuse, subapiculate. Nut smooth with a prominent white margin all round and a central boss on each side which appears somewhat darker, stipitate.

A gregarious sedge of marshes and pools. Throughout the Presidency fairly common (Indo-Malayan).

6. **F. argentea,** *Vahl.* 3-6 inches, densely tufted, leafy at the base. Spikelets $\frac{1}{4}$ in. in a dense capitate cluster, greyish. Glumes obtuse with a green keel. Nut very minute, smooth.

A gregarious herb of the sloping margins of small tanks about high flood level. Not common North Gujarat, South Carnatic. Probably elsewhere also, but could never be more than local owing to its exclusive choice of habitat. (Indian).

7. **F. aestivalis,** *Vahl.* 2-8 inches, densely tufted, more or less puberulous. Umbel sub-compound, bracteate. Spikelets small, often elongate, grey-brown. Glumes acute. Nut quite smooth except under very strong magnification, pale.

A gregarious herb of dried sand or mud. Throughout the Presidency, except perhaps North Gujarat, where it will probably be found sooner or later. (Indo-Malayan). Exactly resembles *F. dichotoma*, from which it can be distinguished only by the nut.

8. **F. dichotoma,** *Vahl.* As the last species, but nut prominently ribbed and trabeculate.

A gregarious herb of dried mud or sand. Throughout the Presidency, abundant. (Warm regions of the Old World).

9. **F. spathacea,** *Rotlb.* Glaucous with a woody rhizome and numerous hard spreading leaves. Stems 8-16 in. Umbel open or contracted. Spikelets middle-sized. Glumes very obtuse with scarious margins. Nut turbinate in outline, dark, smooth or slightly rough.

A solitary herb of salt flats either coastal or inland. (Warm regions of the Old World).

10. **F. diphylla,** *Vahl.* Perennial, 6-24 inches. Leaves many, basal, shorter than the stem. Umbel various. Spikelets $\frac{1}{5}$-$\frac{3}{8}$ in., usually acute. Glumes glabrous, acute or subacute, usually apiculate, back obtusely keeled. Nut pale, many-ribbed and trabeculate.

Throughout the Presidency, except North Gujarat, where it will probably be found, common in the South. (Most warm regions).

A very variable plant and difficult to describe. The nut distinguishes it from all Bombay species of Section *DICHELOSTYLIS* except *dichotoma* from which it may be distinguished by the larger and more solitary habit and less keeled glumes.

(*b*) *Var* **annua** (sp.), *Roem and Sch.* Annual, very slender, with few and smaller spikelets.

Khandala and Bombay.

(*c*) *Var* **pleristriata,** *Cke.*

A specimen from Khandala in Herb. Agr. College, much larger in all its parts and with about 20 ribs on the nuts seems referable here.

11. **F. ferruginea,** *Vahl.* Upto $2\frac{1}{2}$ ft. Leaves few or 0. Umbel large, usually simple. Spikelets large, acute, red-brown. Glumes very broad with a prominent acute or sub-acute tip, and usually pubescent on the back in the upper half. Nut stipitate, subdisciform, margined, smooth, usually umbonate.

A gregarious sedge of marshes and river-beds. Very abundant throughout the Presidency. (All warm regions).

Section IV. TRICHELOSTYLIS. *Spikelets more than one. Style tri-fid. Ovary and fruit trigonous.*

Key to the section :—

A. Spikelets in a capitate head, white .. .. 12. *F. digitata.*
B. Spikelets not capitately arranged.
  (1) Small annuals.
    (*a*) Nut white, trabeculate .. .. .. 13. *F. Woodrowii.*
    (*b*) Nut white, yellow or grey, tuberculate .. 14. *F. tenera,* Var. *oxylepis.*
  (2) Medium or tall.
    (*a*) Base of stem thick, rhizomatous, leaves short, pungent crowded, a denizen of grass-land .. .. 15. *F. junciformis.*
    (*b*) Not as (*a*).
      (*i*) Stem triquetrous above, glumes obtuse. 16. *F. miliacea.*
      (*ii*) Stem 4-5 angled above, glumes acute.. 17. *F. quinquangularis.*
      (*iii*) Stem flattened above, lowest bract broad, quite erect .. .. .. 18. *F. complanata.*

12. **F. digitata,** *Boeck.* 4-6 inches. Spikelets in a capitate head, whitish, often upcurved.

A slender short-lived sedge of grassy banks in the heavy rainfall tracts. Flowers June-August. On and below the ghats, common. Also according to Cooke found at Badami by Woodrow. But this is out of its natural habitats. (Endemic).

13. **F. Woodrowii,** *Cke.* 2-5 inches, often tufted. Umbels subcompound, but contracted. Spikelets small, acute, mucronate; nut pale, faintly ribbed and trabeculate.

On the ghats at Khandala and Igatpuri. (Endemic).

14. **F. tenera** *Var.* **oxylepis,** *Cke.* 4-8 inches. Spikelets as last species, but rather larger. Nut very round, trigonous, white to yellowish or very often grey, glistening as though varnished, prominently irregularly tuberculate.

Throughout the Presidency, not uncommon (Indian). This must be the species described by Cooke under *F. monticola,* Steud. Apparently he knew it only from one specimen of Woodrow's. Since then much has been collected. I have examined a mass of material from places as far removed from one another as Ahmedabad, Khandesh, Kolaba, Igatpuri, Khandala and Badami, especially a large number of gatherings by Fr. Blatter and Mr. Hallberg and have examined the nuts of all and find them as described. The Bombay specimens have all glabrous (glabrate, Clarke) glumes. On the other hand most of the specimens collected by Fr. Blatter and Mr. Hallberg in the Rajputana desert have softly puberulous glumes. This is *F. tenera* type, and would probably be found in the Thar and Parkar District of Sind. *F. monticola* is apparently a South Indian and especially South Indian mountain form of the same species.

15. **F. junciformis,** *Kunth.* Glabrous. Rhizome woody, creeping. Stems 4-12 inches long, stiff, arising from amidst or in front of the short, densely crowded, flat, spreading or recurved leaves, which have an obtusely triangular white apex. Umbel open or contracted, usually compound. Spikelets clustered, smallish, usually obtuse, dark or reddish brown. Styles and anthers v. conspicuous in time of flowering. Nut obovoid, apiculate, from white to light brown, smooth or sub-verrucose, apparently velate (*i.e.*, outermost cells withering and peeling off).

A stiff, wiry sedge of dry grasslands, forming one of the principal constituents of the surface vegetation on the most barren gravelly uplands in the South Carnatic, and thence spreading into forest clearings. Throughout the Presidency but apparently not very common except in the south. This may, however, be due to its short flowering season, *i.e.*, the very early part of the rains. (India, Madagascar, Philippines).

16. **F. miliacea,** *Vahl.* 6-30 inches high, stem triquetrous, often with very compressed base and subdistichous leaves. Inflorescence a decompound umbel. Spikelets small, obtuse, usually sub-globose. Glumes obtuse or subacute. Nut white or yellow, tuberculate and microscopically transversely striolate.

A gregarious sedge of damp places and rice-fields. Throughout the Presidency, v. common (all warm regions).

17. **F. quinquangularis,** *Vahl.* Resembling the last species, but usually rather taller. Stem 4-5 angled. Spikelets longer and more acute. Glumes acute or sub-obtuse. Nut as the last.

The very same habitats and distribution as the last species and very closely allied to it.

18. **F. complanata,** *Link.* Resembling the last two species, but stem quite flattened below the inflorescence, and lowest bract broad, flat and erect, like a continuation of the stem. Spikelets rather longer. Glumes very acute, keel long excurrent. Nut pale, minutely tubercled, sometimes only on the shoulders.

In water holes in various parts of the Presidency. Apparently uncommon. (Warm regions of the Old World).

(*b*) *Var* **microcarya,** *Cke.* "Stems slender, hardly flattened under the umbel. Spikelets more slender. Nut very small, velate."

"Deccan, water holes at Hewra, Dalzell. Poona, Woodrow." Cooke. I have not seen these specimens. There are no existing sheets in the Presidency, but the available material of this species is very scanty.

6. **Stenophyllus,** *Rafin.*

(= Bulbostylis, *Kunth.*)

Annuals. Stems very slender, tufted. Leaves finely linear or quite capillary. All parts of the plant liable to be hairy or puberulous. Inflorescence capitate, or a simple or compound umbel, but then always with one sessile spikelet in the fork of each branch system. Bracts and bracteoles not prominent. Spikelets few—15-flowered always small and narrow. Glumes always with a prominent green keel and yellow or brown side. Style 3-fid. Nut small, always triquetrous or trigonous, white or nearly white, transversely undulate (sometimes obscurely so) with a short stipe and a (usually dark) umbo left by the style. (Species about 70. All warm regions).

This genus is very closely allied to *Fimbristylis* especially *F. tenera* and its varieties. According to C. B. Clarke it is also closely allied to *Eleocharis*, but it would not appear so from the Bombay species of the two genera. They are all plants of sand or light soil, especially the first two. The three Bombay species are very closely allied to one another.

Key to the genus :—

1. Spikelets in a capitate head .. . .. 1. *S. barbata.*
2. Spikelets in a contracted umbel or compound umbel, stem pubescent below the inflorescence .. .. 2. *S. puberula.*
3. Spikelets in a lax umbel or compound umbel, stem glabrous below the inflorescence .. .. 3. *S. capillaris* Var. *trifida.*

1. **S. barbata,** *Rottb.* (under *Scirpus*). *Bulbostylis barbata*, Kunth. A small tufted herb, 2-8 inches high.

The Bombay specimens show many conditions of glume, from simply acute to acuminate with a recurved, scaberulous mucro, equalling and even exceeding the glume. The Badami specimens especially with their few-flowered spikelets and squarrose mucros look like a separate species and this applies also to specimens collected by Fr. Blatter on Mt. Abu and in South India. I suspect that there are two species mixed here. but for reason given in the introduction have left all the material here.

On sand or light soil throughout the Presidency, especially abundant in sandy fields in North Gujarat and thence onwards into the desert. (India. Africa, Madagascar).

2. **S. puberula,** *Poir.* (under *Scirpus*). *Bulbostylis puberula,* Kunth. 10-12 inches high. Umbels sub-compound, $\frac{1}{2}$-1 inch broad, corymbiform, containing 20 or more spikelets.

V. rare, Karwar on the sandy shore, Mr. T. R. D. Bell, 1917, (Africa. Malaya).

3. **S. capillaris,** *Wallich* (under *Scripus* in *Roxb. Pl. Ind. ed. Carey and Wallich*). *Bulbostylis capillaris,* Kunth. Var **trifida** (sp. Kunth). 6-20 inches high. Umbels lax with few capillary rays $\frac{1}{4}$-1 inch, themselves often branched, and often with a secondary umbel almost as big as the primary umbel; ultimate pedicels usually deflexed in fruit.

Very occasional in the South of the Presidency. (All warm regions of the Old World).

7. **Eleocharis,** *R. Br.*

Glabrous, small or medium sized herbs. Leaves reduced to sheaths, but barren stems often present. Inflorescence a single erect terminal spikelet, ebracteate, but the lowest glume often sub-bractiform. Glumes spirally imbricate, never truly acute. Hypogynous bristles present, occasionally absent. Style branches 2 or 3. Style always dilated at the base, the base usually constricted above the nut, but persistent. Nut obovoid, plano-convex in the species with bifid, trigonous in the species with trifid styles.

Key to the Bombay species :—

A.—Robust. Glumes concolorous. Spikelets $\frac{5}{8}$ in.—$1\frac{1}{4}$ in.
- 1. Stem terete, septate when dry .. .. 1. *E. plantaginea.*
- 2. Stem trigonous or triquetrous, not septate when dry,—
  - (*a*) Spikelets acute, glumes sub-acute .. .. 2. *E. fistulosa.*
  - (*b*) Spikelets obtuse, glumes obtuse .. .. 3. *E. spiralis.*

B.—Small. Glumes with a green central band and scarious sides :—
- 1. Spikelets $\frac{1}{4}$—1 inch, with a creeping rhizome. 4. *E. palustris.*
- 2 Spikelets less than $\frac{1}{4}$ inch—
  - (*a*) Style bifid, nut biconvex—
    - (i) Very slender, bristles white .. .. 5. *E. atropurpurea.*
    - (ii) Less slender, stems stiff, bristles brown 6. *E. capitata.*
  - (*b*) Style trifid, nut trigonous .. .. 7. *E. chaetaria.*

1. **E. plantaginea,** *R. Br.* Stoloniferous, creeping in the mud. Stems 1-3 ft. high (as clavis). Spikelets $\frac{3}{4}$-$1\frac{1}{4}$ in., straw-coloured.

A gregarious sedge filling and almost monopolizing the beds of small tanks in the extreme north of the Presidency. Also in the Mallad tract of the Carnatic. (Tropics of the Old World).

2. **E. fistulosa,** *Link.* Stoloniferous, 1-3 ft. high (as clavis). Spikelets about 1 in., straw-coloured, acute, with far fewer glumes than the next species. Glumes striate, subacute. Nut with narrow horizontal outer cells in vertical series giving the effect of faint striæ and trabeculæ*.

South of the Presidency. (Scattered through N. E. and S. W. India and Burmah. Tropics generally).

3. **E. spiralis,** *R. Br.* Stoloniferous, 1-2 ft. (as clavis). Spikelets about $\frac{3}{4}$ in., straw-coloured, elegant cylindric, obtuse, with innumerable quadrate obtuse glumes, their tips making spiral lines around the spikelet. Nut more or less as last species.

A Konkan species. Bassein and Sion (Herb. St. X. Coll.) Salsette and Goa (ex Cooke). (Scattered throughout heavy rainfall tracts in low-lying parts of India).

4. **E. palustris,** *R. Br.* Rhizomatous, rooting from the nodes. Stems variable, medium to stoutish. Spikelets $\frac{1}{4}$-1 in., straw-coloured or chestnut. Nut yellow or pale brown. Bristles brown.

Sind. Woodrow (ex Cooke). No specimens available in the Presidency now. (In India confined to the northern belt. Otherwise cosmopolitan except Australasia).

5. **E. atropurpurea,** *Kunth.* Tufted, 2-4 in.. v. slender, stems almost filiform and flaccid. Spikelets v. small. Clarke says $\frac{1}{8}$-$\frac{1}{3}$, but the Bombay specimens are all $\frac{1}{8}$ in or less. Nut minute, very glossy, black. Bristles pure white or occasionally with a yellowish tinge especially at the base.

A northern species, from Sind through Gujarat to Sion and Kalyan. No specimens from further south. (North India, Ceylon, tropics generally).

6. **E. capitata,** *R. Br.* Tufted (specimens from Dhulia show a short slender rhizome), 2-8 in., stems less slender than the last species, stiff. Spikelets v. small, (Clarke says $\frac{1}{8}$-$\frac{1}{2}$ in. but the Bombay specimens are all about $\frac{1}{8}$ in.) Nut slightly larger, than the last species, dark, glossy. Bristles red brown.

Scattered throughout the Presidency, but mainly in the Deccan tract from Khandesh to Bagalkot. Apparently not uncommon in the Central Deccan. (Most warm countries).

7. **E. chaetaria,** *Roem. & Sch.* Stems in the Bombay example thread-like, copiously interlaced. Spikelets $\frac{1}{8}$ in. Glumes expending, leaving the top of the spikelet gaping. Nut trigonous, grey, with pointed shoulders and perforate outer cells, giving a dotted appearance.

Extreme south of the Presidency only, Castle Rock and Londa. (Scattered throughout the tropics).

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* NOTE.—This species is supposed to have spikelets broader than the stem. Specimens from Bommigatti, Dharwar Dist, (Herb. Sedgwick) have stems much broader than the spikelets. In other respects however these specimens seem to be indubitably referable to this sp.

8. Scirpus, *Linn.*

Glabrous, leafy at base or leaves reduced to sheaths. Stems terete or trigonous. Inflorescence either of one terminal spikelet or a lateral dense head, or of lateral or terminal open or contracted umbellate corymbs. Spikelets clustered or solitary, many-flowered. Hypogynous bristles normally present, sometimes flattened and plumose, often reduced, (sometimes absent or present at random in one individual). Stigmas and nut as in *Fimbristylis.* (Species 136. Cosmopolitan).

Key to the genus :—

A. *Inflorescence normally a single lateral sessile head of sessile spikelets. Glumes not squarrose.*
  1. Stems stout, septate when dry, head usually near the base of the stem, bristles 0. Nut triquetrous .. .. 1. *S. articulatus.*
  2. Stems stout, septate when dry, head usually near the apex of the stem, bristles present, nut trigonous .. .. .. 2. *S. mucronatus.*
  3. Stems medium, head usually near the apex of the stem, spikelets few terete, turgid, ovate, acute, glumes broad incurved, shortly aristate, bristles present. Nut plano-convex or biconvex .. .. 3. *S. erectus.*
  4. Stems rather slender, head usually above the middle of the stem, spikelets yellowish, flaccid, glumes 5-ranked, concave, inflated in the upper part. Bristles 0. Nut triquetrous .. .. 4. *S. quinquefarius.*
  5. Stems slender, head usually above the middle of the stem, often not compact, spikelets often pedicillate, whitish, firm, glumes not as 4, bristles 0. Nut triquetrous .. .. 5. *S. supinus.*

B. *Inflorescence normally a lateral or terminal compound corymb.*
  1. Spikelets clustered, 2 or 3 together on the tips of the pedicels, golden yellow, flaccid. 6. *S. corymbosus.*
  2. Spikelets solitary on the tips of the pedicels.
    (*a*) Spikelets elongate, acute, glumes bifid at the apex with an interposed arista, bristles retrorse-scabrid .. .. .. 7. *S. maritimus.*
    (*b*) Spikelets elongate, acute, glumes notched at the obtuse top with an interposed arista bristles plumose with multicellular hairs .. .. 8. *S. litoralis.*
    (*c*) Spikelets shortly almost globosely ovoid obtuse, very numerous in a supra-decompound corymb ; bristles scabrid .. 9. *S. grossus.*
    (*d*) As (c) but with bristles plumose .. .. 10. *S. kysoor.*

C. *Inflorescence a compact terminal bracteate head of minute spikelets* .. .. 11. *S. michelianus.*

D. *Very slender, almost filiform. Inflorescence a sublateral head of few small spikelets with squarrosely aristate glumes* .. .. .. 12. *S. squarrosus.*

1. **S. articulatus,** *Linn.* Stems tufted, thicker than a lead pencil. Heads (see *b*) $\frac{3}{4}$ in. Spikelets (see *b*) $\frac{1}{2} \times \frac{1}{4}$. Nut finally black triquetrous transversely rugose (see *b*).

Very common throughout the Presidency, in the margins of tanks. (Africa, Philippines, Australia).

(*b*) Thicker and taller. Heads up to $1\frac{1}{2}$ in. Spikelets up to nearly 1 inch and thicker than type. Nut smooth, a little larger than type.

Same distribution as the type in the Presidency. I doubt whether this is to be regarded as a variety or not. With the extra development of all parts of the plant, the outer cells of the nut presumably have to expand with the result that the corrugations are lost.

2. **S. mucronatus,** *Linn.* Same size and habit as the last. Differences as clavis.

Rare. Prantij, Ahd. Dist. (Herb. Sedgwick). Yellapur (Herb. Talbot). (Warm parts of the world except America). The plant is fairly common on the Nilgiris.

3. **S. erectus,** *Poir.* 18 in. high. Stems about $\frac{1}{8}$ in. thick at most. Tufted; rest as clavis.

Marshes and ricefields apparently only in N. Kanara. (Most warm regions).

4. **S. quinquefarius,** *Ham.* As clavis. Nut transversely wrinkled. Much smaller than *S. articulatus* and can be distinguished from the next by the flaccid spikelets with loose glumes. The colour of this species is golden yellow, of the next green and white.

In ricefields. All parts of the Presidency, but pre-eminently a northern plant, and therefore rare in the south, but common in Gujarat and northward into the desert. (Central Asia, Transvaal, North India).

5. **S. supinus,** *Linn.* As clavis. See also last sp.

Throughout the Presidency. Not so common as the variety. (Almost cosmopolitan).

Var. **uninodis,** *Clarke.* Inflorescence broken up into single or clustered spikelets on rays ($\frac{1}{4}$—$\frac{1}{2}$ in.) of a quasi-umbel.

Commoner than the last.

Note.—This variety is of very doubtful validity. All intermediate stages occur.

6. **S. corymbosus,** *Heyne.* Tall, 3 ft. Inflorescence compound, as clavis. Nut trigonous (rather obtusely so), black, nearly smooth, with a pyramidal apex.

Clarke and Cooke both describe the species as devoid of bristles, but the available specimens all show that most nuts have three bristles of unequal size and various shapes. They approach the bristles of *litoralis*. In one or two cases the bristle has a lateral hyaline wing.

Apparently scattered through the Presidency, but rather rare. (Scattered throughout India, Madagascar). Available at Mt. Abu.

7. **S. maritimus,** *Linn.* Tall, 3 feet. Rhizome creeping bearing tubers. Spikelets dull pale brown or whitish, $\frac{1}{2} \times \frac{1}{4}$ in. Nut trigonous, pale, smooth.

Throughout the Presidency, common, especially on sand in riverbeds. (Cosmopolitan).

Var. **affinis,** *Clarke.* Inflorescence a compact head of sessile spikelets larger and whiter than type. Nut smaller, style bifid.

Throughout the Presidency, with the type.

8. **S. litoralis,** *Schrad.* Tall, 3 ft. Spikelets brown $\frac{1}{3} \times \frac{1}{4}$ in. Glumes more elegant than the last, very concave, so that in drying they develop transverse plaits in the upper part. Nut plano convex.

Scattered throughout the Presidency, but apparently not common. (Scattered throughout the Old World).

9. **S. grossus,** *Linn.* Very tall up to 10 ft. Leaves very broad, up to $1\frac{1}{2}$ in. thick and spongy, transversely septate between the veins when dry. Spikelets innumerable, $\frac{1}{5}$ inch. Nut trigonous. Bristles simply scabrous. (Clarke; "retrorsely scabrid," Cooke).

Scattered throughout the Presidency. Apparently rare. (Indo-Malayan)

10. **S. kysoor,** *Roxb.* As 9, but bristles plumose with multicellular hairs. Tubers of stolos edible.

Scattered throughout the Presidency, mainly N. Konkan and Gujarat.

Note.—Cooke has restored Roxburgh's species. I am unable to separate satisfactorily the available material, which quite possibly does not contain any sheets of the true *S. grossus* at all. *S. kysoor* is evidently far more common.

11. **S. michelianus,** *Linn.* Exactly resembles the very common *Cyperus pygmaeus*, Roxb., in every particular except that the glumes are spirally imbricate. The two plants presumably represent parallel lines of development in the two genera—low rosette plants of dried mud.

Distribution in the Presidency uncertain. It is presumably often passed over. (Old World).

12. **S. squarrosus,** *Linn.* 3-6 inches high, stems and leaves filiform. Spikelets $\frac{1}{6}$ in. Glumes with hunched shoulders and a squarresely spreading aristate tip. Nut extremely minute.

App. very rare. There are only one or two available specimens, two without locality and one from Kanara. (African, Indo-Malayan and E. Asian).

I exclude *S. Kyllingoides Boeck* given by Cooke on the authority of the words "Kanara. Young" in F.B.I. No available specimens either in Cooke's time or now. But there is no reason why the plant should not be found.

9. **Eriophorum,** *Linn.*

Glabrous. Stems leafy at the base. Inflorescence various. Spikelets many-flowered. Glumes imbricate all round the rhachilla. Hypogynous bristles 6, divided to the base into innumerable fine segments, which increase and lengthen,—heads thus ultimately comose.. Style slender, normally trifid. Nut sessile. trigonous, smooth, dark, with narrow apex. (Species 10, mainly Arctic or N. Temperate).

1. **E. comosum,** *Wall.* Robust. Umbel compound or supra-decompound, 2-8 in. long and wide. Bracts v. long up to 12 in. Spikelets $\frac{1}{3}$ in., reddish brown. Glumes strongly keeled; mucronate. Anthers with a red crest. Nuts nearly $\frac{1}{4}$ in. long very narrowly linear-fusiform. Scales so much divided as to appear more like a pappus, the segments ultimately far exserted.

In the Presidency apparently almost confined to Junnar. Also recorded once from Champaner (perhaps Fort Pavagadh) in Gujarat, and from Sind. (North India and Burma to China).

10. **Fuirena,** *Rottb.*

Glabrous or pubescent. Leafy. Spikelets many-flowered in dense clusters, which are sessile or pedunculate, terminal or axillary. Glumes imbricate all round the rhachilla, always strongly aristate and hairy in the upper half. Hypogynous processes 6. in two series; 3 outer (sepals) bristle-like, small or 0; 3 inner (petals) enclosing the nut, broad, often clawed, three-keeled, rarely 0. Stigmas 3. Nut trigonous, narrow or sub-stipitate below, apiculate or beaked above.

Key to the Bombay species :—

A. Petals 0, leaves glabrous .. .. .. 1. *F. wallichiana.*
B. Petals present,
  1. Petals quadrate, clawed,
    (*a*) Glumes *v.* hairy, nerves concealed by the hairs .. .. .. 2. *F. glomerata.*
    (*b*) Glumes slightly hairy, nerves white, raised, conspicuous .. .. 3. *F. uncinata.*
  2. Petals obovate sessile or nearly so .. .. 4. *F. umbellata.*

1. **F. Wallichiana,** *Kunth.* 1-2 ft. Leaves stiff, erect, narrow, with a strong midrib, glabrous. Nut dark when mature, keeled on the angles, cancellately striate.

Deccan, from Khandesh to E. Belgaum. Should be found sooner or later in the drier parts of Gujarat. (India, the drier northern and central parts).

2. **F. glomerata,** *Lam.* 4-18 in. Leaves not stiff, 3-5-nerved, hairy. Petals quadrate on a long or short claw, tricuspidate at the apex and semi-hastate at the base, brown. Nut usually pale, prominently triquetrous.

Throughout the Presidency, especially in ricefields, locally common (African and Indo-Malayan.)

3. **F. uncinata,** *Kunth.* 4-8 inches with spreading stiff hairs. Leaves hairy. narrow. Spikelets densely clustered on v. short peduncles, $\frac{1}{8}$-$\frac{1}{5}$ inch, few-flowered. Glumes much less hairy than in the last sp., pubescent, with v. prominent hard white nerves, the midnerve usually squarrosely recurved. Rhachilla obsolete (*i.e.*, each glume carrying away part of the rhachilla when spikelet dissected). Petals round-quadrate, very shortly clawed, nerves not prominent as in the last; margins especially in the upper part softy and densely fringed with sulphur-coloured ciliolæ.

V. rare. Only in Kanara. (Herb. Kew and Herb. Talbot.) (India in one or two places).

The specimen in the Talbot Herbarium is very different from *F. glomerata.* The prominent white raised nerves of the glumes are a noticeable feature.

4. **F. umbellata,** *Rottb.* 1-4 ft. Stem quadrangular. Leaves usually broad, stiff, strongly 3—5-nerved. Clusters of spikelets bracteate, often subpaniculately compound. Petals obovate-quadrate, apiculate at the apex, narrowed at the base. Nut usually pale, prominently beaked, angles keeled.

In marshes; app. rare, except at Castle Rock. (Most warm, not too dry, regions).

11. **Lipocarpha,** *Br.*

Glabrous. Leafy only at base. Spikelets many-flowered in a single head subtended by stiff always deflexed bracts. Scales 2, arranged anterior and posterior to the nut, clinging to the nut even when mature, and appear like a membranous outer covering. Nut small, plano-convex, smooth.

1. **L. argentea,** *Br.* Spikelets whitish. Resembles a robust form of *Kyllinga triceps.*

Marshes on the crest of the Southern Ghats. (Throughout India. Warm regions of Old World).

2. **L. sphacelata,** *Kunth.* Spikelets dark chocolate brown, smaller than the last.

Occasional in marshes and rice-fields in the Karnatic Mallad tract. (Throughout India. Tropical Africa and America).

12. **Remirea,** *Aublet.*

One species only.

1. **R. maritima,** *Aubl.* A glabrous maritime sedge with a long creeping rhizome. Branches erect, 2-6 inches, stiff, entirely clotted with the sheaths of the leaves, the blades of which are ascending, rigid, pungent, concave. Spikelets one-flowered, densely crowded on short spikes, which are sessile and aggregated into dense heads, supported by bracts like the leaves. Nut narrow, obscurely trigonous, pointed, dark.

Coast near Karwar (Herb. Talbot). (Tropical sea-coasts).

13. **Rhyncospora,** *Vahl.*

Habit various but often with stem leafy. Inflorescence various. Spikelets with 3 or 4 shorter lower empty glumes, 1 or 2 middle longer, fertile, and 1 upper male (in the Bombay species), golden brown. Stigmas 2. Nut biconvex, crowned by the much enlarged conical style base. (Species 150, in the warmer or temperate regions of the world, especially America. English "Beaknut").

1. **R. Wightiana,** *Steud.* 6-16 inches. Leaves all basal. Spikelets numerous in a single crowded bracteate head. Bracts rigid, dilated and ciliate at the base. Bristles 6, golden, scabrid with erect teeth, twice or more than twice as long as the nut. Nut laterally flattened $\frac{1}{8}$ in. or slightly less, black but rendered greyish by the numerous scabrid white papillæ, which point upwards.

Exclusively confined to the heavy rainfall region both above and below ghats from Igatpuri and Bassein to Kanara, and very common on open grassy land in that region in the monsoon. (India, W. Peninsula, Cochin China).

Note.—I exclude *R. Wallichiana*, Kunth., which Cooke gives on the authority of Woodrow as occurring at Kalyan. I have examined a considerable material in the four Herbaria and find all the specimens absolutely constant as above described. *R. Wallichiana* has a much shorter, turgidly biconvex, smooth nut, dorsally compressed (as *Juncellus*) and short or obsolete bristles. Owing to pressure in drying, the nuts in *R. Wightiana* often become displaced and give a mistaken impression of being dorsally compressed. *R. Wallichiana* is an eastern species, of which apparently *R. Wightiana* is the western form.

2. **R. aurea,** *Vahl.* 2-3 ft. Leafy throughout with long leaves Spikelets numerous, clustered or spikately arranged on the branches of large, multiple, bracteate corymbs. Bristles 6 or fewer, shorter than the nut. Nut large up to $\frac{1}{3}$ in., more than half of which is occupied by the stout channelled beak.

Apparently only in streams and marshes on the crest of the Southern Ghats, but possibly more widely distributed. (India E. and S. Warm regious of the world).

14. **Hypolytrum,** *Rich.*

Leafy upwards. Leaves flat 3-nerved. Inflorescence paniculate with rigid divaricate branches. Spikes many-flowered, resembling the spikelet of other *CYPERACEOUS* genera. Spikelets reduced to one obtuse glume within which is a reduced rhachilla bearing two basal stamens supported by scales and one terminal pistil.

Stigmas two. Nut turgid. (Species about 30-40. Tropical regions).

Note.—The limitation of the species appears to be difficult and our species, as all the Indian species, is regarded by Clarke merely as a form of *H. latifolium*, Rich.

1. **H. Wightianum,** *Boeck.* 2-3 feet, stout. Spikes (as above) up to ¼ inch. Glumes speckled. Nut ⅛ inch, ovoid, turgid, yellow to almost black, usually veined longitudinally, minutely speckled, beak usually paler.

Exclusively confined to the Southern Ghats by rivulets in dense forest. (Malabar region of India. Nicobars).

15. Scleria, *Berg.*

Leafy, leaves usually narrow, often cutting the hand with their scabrous margins. Inflorescence of axillary or panicled spikes. Spikes compact or lax. Spikelets usually unisexual, rarely bisexual. Flowers unisexual, supported by several glumes. Style trifid. Nut osseous, usually prominently exserted, globose or nearly so, usually either white and shining or covered with minute ferruginous pubescence, smooth or variously sculptured, usually supported on a gynophore, the apex of which is usually dilated into a 3-lobed saucer. (Species 150. Tropical and subtropical—not too dry—countries).

The available material for the Bombay species of this attractive but difficult genus is so scanty, that I cannot attempt more than a *prodromus* at present. The plants of this genus are all hygrophytic and rather autumnal. They are extremely local and scattered, never gregarious, and often not very noticeable. Consequently they have apparently been much neglected. There seems little doubt that there are several Bombay species at present undescribed. I would bring to the attention of Collectors the desirability of preserving the nuts in separate packets on the sheets. The ripe nuts are easily deciduous. They fall away during the process of drying and mounting and even afterwards, and being globose and often very smooth they roll away and are lost. As the discrimination of species depends mainly on the mature nuts their absence renders it often impossible to allocate a sheet satisfactorily.

A.—*Spikes reduced to small axillary scarcely exserted clusters, nut minute, not exserted, longitudinally fluted.*

1. **S. caricina,** *Benth.* A delicate little plant, 1-8 in. Leaves about 1 in., linear, acute, in the Bombay example. Nut-bearing glumes with a central acumen and lateral blunt teeth. Nut smaller than a pin's head, white, the longitudinal ridges brown, (in the Bombay example).

App. v. rare. Yellapur (Herb. Talbot). Indo-Malayan region and China.

B.—*Spikes elongate. Nut far exserted.*

(1) Disc obsolete. Nut smooth.

2. **S. lithosperma,** *Sw.* Rhizomatous. Stems 1½-3 ft. Very slender. Leaves long, v. narrow. Spikes v. lax with remote flowers. Nut smooth, white, glabrous. Disc represented by a mere discoloration of the base of the nut.

App. rare, and only in the heavy rainfall tracts. Talbot's specimen is No. 526 (not 562 as Cooke ex Clarke) (Indo-Malayan in the wetter regions).

(2) *Disc annular. Nut smooth.*

3. **S. annularis,** *Kunth.*

Several feet high. Stem compressed, rather slender. Leaves very long, about $\frac{1}{5}$ inch broad, margins very scabrous. Spikes rather closely paniculately arranged on long axillary peduncles. Nut smooth, white, glabrous : Disc a small unlobed saucer.

Apparently only in the Konkan. (India, irregularly scattered).

(3) *Disc 3-lobed. Nut smooth.*

4. **S. hebecarpa,** *Nees.* 2-3 feet high. Stem rather slender weak. Leaves very long, flaccid, narrow, about $\frac{1}{4}$ in., sheaths prominently winged. Panicle lax. Spikelets rather remote. Nut $\frac{1}{8}$ in., in young states often microscopically puberulous, mature smooth, white. Disc lobes thin, sometimes almost glumaceous, ovate-lanceolate, acute, reaching to $\frac{1}{3}$ way up the nut and appressed to it.

A forest plant, apparently not uncommon in the forests of Kanara ; also from Thana Dist. (Herb. Agr. Coll.) (Indo-Malayan).

Note.—Here may also possibly be placed Talbot's Nos 1888 and 1907, which are more robust with leaves 1 in. broad and sheaths winged up to nearly $\frac{1}{8}$ in. Unfortunately the specimens are both immature without nuts. Or this may be a separate species. Kanara forests.

At this point may be placed a specimen No. 1025 (A) of Herb. Talbot from Yellapur. Slender, 4-9 in. Leaves $\frac{1}{5}$ in. broad, exactly linear, flat, tip obtuse, hairy ; margins smooth. Spikes very short, few-flowered on axillary peduncles. Nut about $\frac{1}{16}$ in., white, smooth, or very obscurely subcorrugose, glabrous, with pyramidal top, not apiculate. Disc 3-lobed, supporting the nut. Lobes thick, wrinkled. This is probably a new species. It is mixed with *S. tessalata,* Willd., and, if not new, would be a very mature condition of that plant, but the nut is smaller and different in general outline.

(4) *Disc 3-6 lobed. Nut cancellately sculptured.*

5. **S. tessellata,** *Willd.* Very slender, (up to $2\frac{1}{2}$ feet, Cooke. Available specimens are much smaller). Leaves rather short, narrow, linear, acute or obtuse, hairy or glabrate, smooth or subscabrid on the margins. Sheaths winged or not. Spikes erect, axillary or terminal simple or sub-paniculate. Nuts 1-12 in., cancellately tessellate with square depression and puberulous with reddish hairs, at any rate when young, apiculate. Disc 3-lobed, lobes ovate, acute or subacute, pale, reaching only a little way up the basal part of the nut.

Heavy rainfall regions, occasional (Indo-Malayan and E. Asia).

6. **S. biflora,** *Roxb.*

As the last ; but lobes of the disc narrowly triangular, acuminate or quite subulate, brown, reaching well up the side of the nut.

Heavy rainfall regions, occasional. (Scattered throughout the wet parts of India).

7. **S. Stocksiana,** *Boeck.* Stouter and more angular than the last two, 1-2 feet. Sheaths strongly winged. Spikes stouter, up to 1 inch or more. Nut $\frac{1}{8}$ in., not deeply cancellate (see however (*b*)), but shallowly corrugose, always shining, white and glabrous, not apiculate, but with a sub-umbonate apex. Disc lobes 3, ovate, subacute, supporting the nut at the base, thick, with reflexed edges, and with an annular ridge below (the outer lobes of Cooke) which in very mature states is dark with a white edge.

South of the Presidency fairly common. (Endemic).

(*b*) Here may be placed a form from the red laterite plateau near Talod (Ahmedabad District) (Herb. Sedgwick) which differs from the southern type in the nut which is the same size, shape, colour and texture, but is differently sculptured, the cells between the corrugations being deeply perforated. The laterite upland at Talod is separated by long distances from any other laterite, and this may be an isolated local development, or may perhaps be regarded as a new species.

8. **S. elata,** *Thw.* A very tall plant up to 8 or 10 feet high with very scabrid stems, and long, very scabrid leaves, dangerous to handle. Panicle large, 1 ft. by 6 inches or even more. Nut $\frac{1}{8}$ in., quite globose, shallowly tessellated, and puberulous on the ridges with red hairs (cancellæ irregularly distributed, not in regular vertical lines as 5 and 6). Disc 3-lobed, supporting the nut.

Crest of the ghats in the south of the Presidency, not uncommon. (Throughout moister India, Java, China).

16. **Carex,** *Linn.*

Perennials, leafy at the base, or leafy upwards. Inflorescence either of a single spike or of paniculately arranged spikes, which may be unisexual or bisexual, in which case the males may be above and the females below or *vice versa.* Flowers unisexual, supported by a glume. Ovary and nut enclosed in a bottle-shaped utricle, with a short or long (usually bifid) beak. (Species 500 and more. Cosmopolitan, but mainly of cold or temperate climates. The Indian species are mainly mountain plants).

1. **C. Mercarensis,** *Hochst.*

A tall leafy sedge. Panicle large, compound. Spikes $\frac{3}{8}$-$\frac{7}{8}$ in. with about 6-10 laxly-arranged female flowers at the base and males at the top. Female glumes ferruginous brown, more or less aristate. Utricles slightly curved or quite straight, greenish, scaberulous, about 15-ribbed, with a beak about as long as the utricle.

Note.—Cooke regards the Bombay plants as belonging to the *Var* Major, *Steud.*

Quite common in forest on the ghats in the South of the Pesidency, and occasional as far North as Thana (S. W. India).

2. **C. speciosa,** *Kunth.* Leafy at the base only. Spikes solitary ½-1 in. long, whitish, on long slender peduncles. Glumes concolorous, multi-striate. Utricle concave on the ventral, convex on the dorsal side, margins winged, ciliolate, multi-striate.

Very rare. North Kanara (Herb. Talbot).

Note.—I exclude *C. condensata*, Nees. Said to have been found at Mahableshwar by Dalzell and Gibson and in Sind (Beluchistan ?) by Pinwill. This is a North Indian mountain species.

A REVISION OF THE INDIAN SPECIES OF *ROTALA* AND *AMMANNIA*.

BY

E. Blatter, S.J., and Prof. F. Hallberg.

Part II.

(*Continued from page* 722 *of Vol. XXV.*).

Ammania, L. (sens. restr.)

Annual glabrous herbs, growing in damp places. Stem and branches more or less 4-gonous. Leaves decussate, sometimes alternate, sessile, often dilate-cordate at the base, 1-nerved.

Dichasia (1-)3-multiflowered, sessile or pedunculate, axillary: bracteoles small, membranous. Flowers typically 4-merous (exceptionally 5-6-merous, never heterostylous. Calyx campanulate or urceolate, after flowering semiglobose or globose, herbaceous, 8-nerved; appendages 0 or short. Petals 0-4, fugaceous, obovate or rotund. Stamens 2-8, episepalous. Ovary sessile, incompletely 2-4 (-5)-locular or 1-locular. Style 0 or longer than the ovary.

Capsule globose or ellipsoid, included or half-exserted, very thinly membranous, breaking up irregularly in a transverse direction. Seeds very numerous, minute.

There are about 20 species, distributed all over the world, chiefly in the tropical regions. Some of them are well-defined, but most extremely variable and, therefore difficult to distinguish. The genus gives one the impression as if its representatives were in the actual process of evolution.

Key to the Indian Species.

A. Calyx 4-winged. Flowers and capsules very large .. .. 1. *A. octandra*
B. Calyx not winged.
  I. Style distinct. Petals distinct:
    1. Cymes distinctly peduncled:
      a. Peduncles and pedicels stout, flowers and capsules large. A coarse plant. 2. *A. auriculata*
      b. Peduncles and pedicels filiform, flowers and capsules small. A slender and more delicate plant .. .. .. 3. *A. multiflora*
    2. Cymes sessile or subsessile. Flowers and capsules large. A coarse plant .. 4. *A. desertorum*
  II. Style absent or nearly so. Petals absent or small.
    1. Cymes distinctly peduncled .. .. 5. *A. senegalensis*
    2. Cymes sessile or subsessile .. .. 6. *A. baccifera*

1. *Ammannia octandra,* L. f. Suppl. (1781) 127 ; Roxb. Cor. Pl. II (1798) 18, t. 133 ; DC. Prodr. III (1828) 80 ; Wight and Arn. Prodr. 304 ; Blume Mus. Bot. II 132; Dalz. and Gibs., Bombay Fl. (1861) 97 : Kurz in Journ. As. Soc. Beng. (1877), pt. II, 86 ; Clarke in Hook. f. Fl. Brit. Ind. II (1879) 571 ; Kœhne in Engl. Bot. Jahrb. 1 (1880) 250. in Engl. Pflanzenr. IV, 216 (1903) 50 ; Trim. Fl. Ceyl. II (1894) 225 ; Cooke Fl. Bomb. Pres. 1. (1903) 508.—*A. coccinea* Pres. Ench. I (1805) 147, *non* Rottb.—*Ammannella linearis* Miq. Fl. Ind. Bat. 1 (1855) 619 *cum descript erron.*—*Diplostemon octandrum* Miq. l. c. 615.

Stem 15-100 cm. long, erect, stiff, (the upper part 4-gonous, the lower part subterete and often woody), very narrowly 4-winged, the wings minutely serrulate ; branches numerous, sharply quadrangular. Leaves 20-80 mm. long, 2·5-10 mm. broad, sessile, sometimes subacuminate, broadly linear or narrowly lanceolate.

Dichasium 1-3-flowered ; peduncle scabrous, central pedicel 1·5-5 mm. long, lateral ones scarcely 1 mm. Calyx 3 5-6 mm. long, quadrangular, the angles winged and minutely serrulate, tho faces between the wings furnished with a distinct rib in the middle of each face ; mouth nearly truncate or with 4 very short teeth ; cornua short, horn-like. spreading. Petals 4, broadly obovate, upto 4 mm. long, irregularly crenulate, rose coloured, veined. Stamens 8, exserted, filaments dark-red. Style nearly 3-times as long as the ovary.

Capsule included in the calyx, globose-ellipsoid.

Habitat : Madras Pres. : Ragapaliem, Godavari Dist., Feb. 1902 (Barber No. 4259 !), Kambam, Madura Dist., in fields, May (Blatt. and Hall. No. 475 ! 3336 !).

Distribution : India, Ceylon, Java. (Judging from material in the various Indian and European herbaria this seems to be a very rare species).

2. *Ammania auriculata,* Willd. Hort. Berol. I (1806) t. 7 ; DC. Prodr. III (1828) 80 ; Koehne in Engl. Bot. Jahrb. 1 (1880) 244 et IV (1883) 389, in Engl. Pflanzenr. IV, 216 (1903) 45.—*A. racemosa* Roth Catal. bot. II (1806) 25.—*A. arenaria* H. B. and K. Nov. Gen. VI (1830) 190.—*A. senegalensis* DC. Prodr. III (1828) 77 *sec.* Guill. et Perr. (*non* Lam.) ; Clarke in Hook. Fl. Brit. Ind. II (1879) 570 ; Collet Fl. Siml. (1902) 192 ; Duthie Fl. Upp. Gang. Plain I (1903) 350 ; Bamber in Journ. Bomb. Nat. Hist. Soc. XX (1911) 811 ; Hiern in Oliv. Fl. Trop Afr. II (1871) 477 (*partim*).—*A. auriculata* Ledeb Fl. Ross. II (1844-46) 125 ; A. Rich. Fl. Abyss. I (1847) 278.—*A. pusilla* Sond. in Linnæa XXIII (1848) 40.—*A. Wrightii* A. Gray in Smith. Cont. V (1853) 55.—*A. longipes* C. Wright in Souvalle Fl. Cubana (1868) 53.—*A. undulata* C.A. Mey. in Ind. Hort. Petropol. IX (1842) 56.

Stem up to 57 cm. long ; stem and branches winged in the upper part. Leaves 1·5-7·7 cm. long, 3-14 mm. broad, or the upper ones smaller. the two lowest sometimes cuneate, the rest auriculate, linear or sublanceolate, slightly acute.

Dichasia 1-3-15—flowered, slightly lax ; pedicel of the central flower 3-17 mm. long. Calyx 15-2 mm. long, in fruit subglobose or almost semi-globose ; lobes 1/3 or $\frac{1}{2}$ the length of the tube : cornua minute, at last evanescent, rarely almost as long as the lobes. Petals violaceous, purple or white. Stamens 4-8, inserted 3/4—almost $\frac{1}{2}$ way down the tube, 1/3 or $\frac{1}{2}$ exserted beyond the lobes. Style up to twice as long as the ovary.

Capsule 2-3·5 mm. in diameter, as long as the calyx-lobes or slightly longer.

The plant varies slightly, especially with regard to the number of flowers in a cyme, the length of the cyme-branches and of the style.. The different forms pass insensibly one into the other.

It is an interesting fact that almost identical specimens have been gathered in localities widely apart: China, India, Nubia, Transvaal, Texas, Mexico. The African specimens have a slightly smaller capsule and a comparatively longer style than the Indian ones.

In India the species is confined to the driest and coldest regions, as will be seen from the localities given below.

Habitat: Rajputana: Dilvara on Mt. Abu, October 1916 (Blatt. and Hall. No. 3337!), Uria on Mt. Abu. (Blatt. and Hall. No. 3338!), Usrot on Mt. Abu (Blatt. and Hall. No. 3339!), Mt. Abu, (Blatt. and Hall. No. 3340!). British Baluchistan: Khozdar, about 4100 ft., September 1917 (Hotson No. 3348!). Afghanistan: Kurum Valley (Aitchison!). Chitral: Near Drosh, 4-5000 ft. (Hamilton No. 17881!).—N. W. Frontier, September 1907 (Dean!).—British Tibet (Stoliczka!).—Kashmir: Baramula. 5000 ft., June 1905 (Meebold No. 390!).—Gangetic Plain: Banks of Gumpti near Indalpur (Duthie No. 4022!)—Punjab (Thomson!).—Bengal: Between Dingra Ghat and Purneah, in ricefields, October 1868 (Kurz!)—Central China: Prov. Hupeh (Henry No. 2754!), Hainan (Henry No. 8370!). —Persia (Aucher-Eloy No. 4508!).

Africa: Kordofan: Arash-Cool, Oct, 1839 (Kotschy No. 178!), Transvaal, May 1894 (Schlechter No. 4771!).

Distribution: Africa: Cape and Sudan-region, Nile delta: Asia: Trans-Caucasus, Persia, Afghanistan, Baluchistan, India, China. Australia: Queensland. America: Louisiana, Texas, New-Mexico, Cuba, Venezuela, Ecuador, Extratrop. Brazil.

3. *Ammania multiflora*, Roxb. Fl. Ind. I (1820) 447; DC. Prodr. III (1828) 79; W. & A. Prodr. 305; Wall. Cat. 2101; Boiss. Fl. Orient. II, 743; Dalz. and Gibs. Bomb. Fl. (1861) 97; Kurz. in Journ. Asiat. Soc. Beng. pt. II (1877) 85; Koehne in Engl. Bot. Jahrb. I (1880) 247 et IV (1883) 390, in Engl. Pflanzenr. IV, 216 (1903) 48; Duthie. Fl. Upp. Ganget. Plain. I (1903) 351; Cooke Fl. Bomb. Pres. I (1903) 509.—*A. parviflora* DC. l.c. 78.—*A. floribunda* Guill. et Perr. Fl. Seneg. I (1830-33).—*Suffrenia dichotoma* Miq. Fl. Ind. Bat. I (1855) 616.—*A. australasica* F. Muell. in Trans. Phil. Soc. Victoria I (1855) 41.—*A. madagascariensis* Tul. in Ann. Sc. nat. ser. 4, VI (1856) 129.—*A. japonica* Miq. Prolus. (1866-67) 149.

Stem up to 65 cm. high, erect, slightly 4-winged, branches numerous, sharply quadrangular. Leaves opposite, 4-25 mm. long, 0·75-3 mm. broad, the lower ones (or rarely all) attenuate at the base, the rest subauriculate, often persisting for a long time.

Dichasia 1-3-7, or rarely 15-20-flowered, peduncled; central pedicel 2-6 mm. long; bracteoles on the cyme-branches most minute, linear. Calyx campanulate, 1-1·5 mm. long, semiglobose in fruit, teeth 4, short, triangular. Petals small and caducous. Stamens 4, as long as the calyx-lobes, or slightly longer. Style about as long as the capsule.

Capsule 1·5 mm. in diameter, half-surrounded by the calyx-tube, protruding from between the lobes.

Habitat: S. India: Mysore, 1-3000 feet, October 1908 (Meebold No. 10279!); Coimbatore, Kollegal, 2,000 ft. (Fischer No. 659!); Ambattur in Chingulpet Dist., February 1915 (Fyson!); Madras, March 1899 (Fyson!); Bombay Presidency: Sion on Bombay Island, November 1916 (Blatt. and Hall. No. 3353 !); Bhandup in Salsette, near tank (Blatt. and Hall No. 3354 !); Andheri in Salsette, December 1916 (Blatt. and Hall. No. 3355 !); Bandra (Poona Herb. !); Bassein (Poona Herb.!) ; Khandala, March 1917 (Blatt. and Hall. No. 3356 !); Igatpuri, January 1917 (Blatt. and Hall. No. 3357-3372 !); Poona, common. Khandesh: Bor, along Tapti river (Blatt. and Hall No. 3373 !) ; Bhusawal, Tapti river, December 1916 (Blatt. and Hall. No. 3374! 3375 !); Dharwar Dist., dry ricefields, December 1916 (Sedgwick No. 2272 !). Mt. Abu: Dilwara, October 1916 (Blatt. and Hall. No. 3381 !) ; slopes of Mt. Abu, November 1916 (Blatt. and Hall. No. 3382 !), Abu Road, November 1916 (Blatt. and Hall. No. 3383 !) ; Rajputana Desert: Kailana near Jodhpur, October 1917 (Blatt. and Hall. No. 3384 !, 3385 !) ; Balarwa (Blatt. and Hall. No 3386 !) ; Devikot (Blatt. and Hall. No. 3387 ! 3388!) ; Vinjorai, November 1917 (Blatt. and Hall. No. 3389 !) ; near Kotda (Blatt. and Hall. No. 3390 !). N.-W. India: Banks of Gumpti near Indalpur, October 1885 (Duthie No. 4024 !) ; Punjab (Thomson !), Afghanistan (Griffith No. 2316 ! 2315 !). Central India: Indore (Calc. Herb.!), Saugor (Vicary !), Goona (King No. 216!), Gwalior (Maries No. 201 !). Bengal: Lower Bengal (Wallich No. 2101 !), between Purnea and Caraghola Ghat, in fields, October 1868 (Kurz !), Howrah Dist (Kurz !), Singbhum, December 1900 (Haines No. 337 !).

We found a few specimens in Khandesh which we put under: *Forma uniflora forma nov.* Dwarf, stem simple, 25-30 mm. high, erect. Leaves shorter than the peduncles, sometimes ovate. Peduncles 1-flowered, 5-6 mm. long, pedicels 0·5-1·5 mm. long.

Habitat: Tapti river near Bhusaval December 1916 and January 1917 (Blatt. and Hall. No. 3379 !, 3380 !).

Distribution: Tropical Africa, Madagascar. Asia: Persia, Kurdistan Afghanistan. India, Andamans to the Philippines and Japan. Australia: N. W. and S. Australia, Victoria, New S. Wales, Queensland.

4. *Ammannia desertorum, spec. nov.*—A course, rigid, more or less scabrous papillose plant. Stem up to 50 cm. high, much-branched, stout, subterete below, sharply quadrangular and narrowly winged above, as are also the branches. Leaves lanceolate, acute or subobtuse, up to 70 mm. long and 8 mm. broad, auricled at the base, feather-veined, midrib prominent below, margins reflexed.

All the axils flower-bearing. Peduncles absent or very short, not reaching 1 mm. in length, stout, (1—) 3-(6)-flowered. Pedicels very uniform in length, 1-2 mm., stout. Bracteoles minute, stiff, subulate. Calyx leathery, 8-nerved, in flower 2 mm. long, elongate-campanulate, in fruit up to 2·5 mm. long, campanulate-semiglobose. Teeth 4, small, broadly triangular, apiculate; accessory teeth or folds very small or absent. Petals 4, small, reaching 1 mm., obovate-cuneate, purple, caducous. Stamens 8, inserted at about $\frac{1}{3}$ of the tube from below, sub-included. Style about as long as the ovary, $\frac{1}{3}$-$\frac{1}{2}$ as long as the capsule, rather stout.

Capsules 3 mm. long, crowded together, the upper $\frac{1}{4}$ or $\frac{1}{5}$ not covered by the calyx, reddish-brown transparent, shining. Seeds very numerous, irregularly semiglobose, yellowish brown, shining.

This species has the habit of *A. auriculata*, but can easily be distinguished by its inflorescence. Generally the whole plant is covered with capsules.

The plant is common in the Rajputana Desert S. of Jaisalmer. Vern. Name: Jalbhangra (Marwari).

Habitat: Jaisalmer: Devikot, November 1917 (Blatt. and Hall. 3341 !), near Devikot, November 1917 (Blatt. and Hall. 3342!, 3343!), Vinjorai (Blatt. and Hall. 3344!); Jodhpur: Kotda near Seu (Blatt. and Hall. 3345!), near Badka on wet ground (Blatt. and Hall. 3346! 3347!).

5. *Ammannia senegalensis*, Lam. Ill. I (1791) 312, n. 1553, t. 77, f. 2; Koehne in Engl. Bot. Jahrb. I (1880) 255, in Engl. Pflanzenr. IV. 216 (1903) 52.

Stem 8-35 cm. long, erect or ascending, rarely prostrate and rooting, sub-4-gonous. Leaves 7-50 mm. long and 1·5-13 mm. broad, oblong or oblanceolate or sublinear, mostly obtuse, the lower ones cuneate at the base, the upper ones rotund or subcordate, rarely all auriculate cordate.

Dichasia 1-3-many-flowered, distinctly peduncled, the central pedicel reaching up to 10 mm. Calyx in flower 1-1·5 mm. long, in fruit semiglobose, cornua minute or obsolete. Petals 4, small or absent. Stamens 4. Capsule 1·5-2·5 mm. in diameter.

Distribution: From Senegambia to S. Africa, East Africa, to Abyssinia and Lower Egypt, India.

Key to the forms:

A. Dichasia lax, central pedicel 3-10 mm. long.
    1. Stem usually diffusely branched at the base. Forma a.
    2. Stem shortly branched above the middle.. Forma b.
B. Dichasia dense; central pedicel not more than 4 mm. long .. .. Forma c.

Forma a. diffusa, Koehne in Engl. Pflanzenr. IV, 216 (1903) 52.—*A. diffusa* Willd. Enum. I (1809) 169; DC. Prodr. III (1828) 79.—*A filiformis* DC. in Mem. Soc. Gen. III (1826) 95, Prodr. III, 77.

Occurs in Senegambia and Lower Egypt, not in India.

We have seen a specimen. It has very long straggling branches from the base, large thin leaves and few-flowered cymes; peduncles of medium length, pedicels long.

Forma b. salsuginosa, Koehne l. c.—*A. salsuginosa* Guill. et Perr. Fl. Seneg; I (1830-33) 302; Hiern in Oliv. Fl. Trop. Africa II (1871) 477.

Occurs in Senegambia from where we have examined a specimen. It is a weak suberect plant with very slender branches, meeting the stem at right angles. Cymes few-flowered, its branches filiform.

Forma c. indica, forma nov. Erect or suberect, up to 20 cm., simple or sparingly branched near the base. Leaves up to 30 mm. long and 4 mm. broad, subacute. Calyx 8-ribbed. Petals present, 1 mm. long, rotund-ovate. (In formalin the mucilage of the ovaries comes out in large masses and the formalin is stained bluish-purple).

Habitat: Bombay Presidency: Khandala, November 1916 (Blatt. and Hall. No. 3349!, 3350!), Igatpuri (Blatt. and Hall. No. 3351!), Poona (Blatt. and Hall. No. 3352!).

In the Poona specimen the stem is ascending, slender, simple. The calyx has a pinkish hue and 8 conspicuous green nerves. Capsule purple. The Igatpuri specimen is 8 cm. high, the stem is simple, the leaves acute, hardly auricled.

There is another specimen from Poona (Aug. 1895) in the Herbarium of the Bom. Nat. Hist. Soc. on a sheet of *Ammannia multiflora*. It is much more luxurious, 17 cm. high, slightly branched, branches slender, patent. Leaves up to 42 mm. long and 5 mm. broad, thin, acute, attenuate or auriculate at the base.

A senegalensis Lam. has not been noted from India before. The *A. senegalensis* mentioned by Clarke in the Flora of Brit. India is *A. auriculata* Willd.

6. *Ammannia baccifera* L. Sp. Pl. ed. 2 (1762) 175; Burm. Fl. Ind. (1768) 38, t. 15, f. 3, 4; DC. Prodr. III (1828) 78; Hiern in Oliv. Fl. Trop. Afr. II (1871) 478 (*pro parte*); Clarke in Hook. f. Fl. Brit. Ind. II (1897) 569; Koehne in Engl. Bot. Jahrb. I (1880) 258, IV (1883) 391, in. Engl. Pflanzenr. IV, 216 (1903) 53; Dalz. and Gibs. Bomb. Fl. (1861) 97; Kurz. in Journ. Asiat. Soc. Beng. pt. II (1877) 85; Cooke Fl. Bomb. Pres. I (1903) 509.—*A. indica* Lam. Ill. 1 (1791) 311; Poir. Supp. 1 (1810) 328; DC. l, c. 77 (*fortassis partim tantum*); Benth. Fl. Austral. III (1866) 297.—*A. vesicatoria* Roxb. Fl. Ind. I (1820) 427; DC. l. c. 78. *Cryptotheca apetala* Bl. Bijdr. (1826) 1129; DC. l. c. 57.—*A. debilis* Blanco Fl. Filip. ed. 2 (1845) 46 (*non* Ait.).—*A. attenuata* A. Rich Fl. Abyss. 1 (1847) 278.—*Hapalocarpum indicum* Miq. et *vesicatorium* Miq. Fl. Ind. Bat. 1 (1855) 618.—*A. ægyptiaca*, Willd. Enum. Hort. Berol. I (1809) 167, t. 6; Delile Fl. D'Eg. (1813) 37. t. 15, f. 3; DC. l. c. 78.—*A. salicifolia* Hiern in Oliv. Fl. trop. Afr. II (1871) 478, *excl. syno.* (*non* Monti); Clarke in Hook. f. Fl. Brit. Ind. II (1879) 569; Dalz. and Gibs. Bomb. Fl. (1861) 97; Cooke Fl. Bomb. Pres. 1 (1903) 509. *A. glauca* Wall. Cat. (1828) 2100; W. and A. Prodr. 305. *A. densiflora* Miq. in Herb. Hohenack. No. 770 (ex Clarke).

We have united *A. salicifolia* as understood by Hiern and Clarke (not of Monti) with *A. baccifera* L., not even retaining them as subspecies as was done before by Koehne. Clarke says: The only character by which *A. baccifera* can be distinguished from *A. salicifolia* are the attenuated leaves. We have examined hundreds of specimens and found that this distinction does not hold good.

Glabrous, erect or subscandent, 8-65 cm. high, often branching. branches usually opposite. Leaves 7-70 mm. long, 1-16 mm. broad, lower leaves usually opposite, cauline ones opposite or alternate, oblong or narrow-elliptic, narrowed at the base, or rounded, or subcordate, or subauriculate, usually obtuse or subacute.

Dichasia (1-) 3-multi-flowered (dense axillary clusters or loose, but very short cymes), sessile or subsessile. Flowers distinctly pedicelled, sessile or subsessile. Calyx 1-2 mm. long; tube hemispheric, teeth 4, broad, triangular, acute, cornua minute or absent. Petals 0 or minute; stamens as long as the lobes or slightly shorter.

Capsule depressed, globose, 1-2 mm., in diam., covered up to ¼ or ½ by the calyx tube, slightly or much longer than the teeth.

Habitat: All over India, the most common species.

Distribution.: Africa, S. and E. Asia, Australia, Europe (where it is probably introduced).

Species excludendæ.

Ammannia lanceolata Heyne and *Ammannia cordata* W. and A. belong to the genus *Nesaea* which may be distinguished from *Ammannia* by the following points :—

(*a*) The dissepiments of the ovary are quite complete and consequently, the placenta is continuous with the style.

(*b*) The capsule opens by a small operculum, the lower part remains and opens subseptifragally or irregularly.

(*c*) There are often 2-4 large bracteoles.

In order to facilitate the correct naming of the three species here concerned we append their descriptions.

Nesæa lanceolata Koehne in Engl. Bot. Jahrb. III (1882) 325, in Engl. Pflanzenr. IV, 216 (1903) 226.—*Ammannia lanceolata* Heyne in Wall. Cat. 2106, 2106E; Clarke in Hook. Fl. Brit. Ind. II (1879) 570. Trimen Fl. Ceyl. II (1894) 225. *Ammannia salicifolia* Thwait. Enum. Pl. Zeyl. (1864.) 241 *quoad var. α tantum* (*non* Monti). *Ammannia triflora* Benth. Fl. Austral. III (1866) 297 (*non* Wall. Cat.)

Annual; stem 6-25 cm. high, quadrangular at the apex. Leaves oblong or narrowly lanceolate, glabrous or minutely puberulous, sub-1-nerved paler beneath.

Flowers sessile or subsessile; bracteoles green or membranous with a green, nerve, lanceolate or almost oblong, as long the calyx or $\frac{1}{3}$ shorter, some times minutely serrulate. Calyx 2.5-3 mm. long, campanulate, lobes $\frac{1}{3}$ the length of the tube or shorter; the appendages slightly shorter or longer than the lobes. Subulate or triangular, glabrous, hispid, or with a few teeth. Petals 0 or 4 (5) and about $\frac{1}{2}$ the length of the calyx, rose. Ovary bilocular, style scarcely longer than the stigma.

Capsule subglobose or globose. Seeds small.

Clarke says the petals are larger than in any other species of Eu—Ammannia, which is certainly not correct.

Habitat: North Kanara: Carwa, in the *Casuarina* plantations, October 1887 (Talbot No. 1575!). Malwan seashore, November 1892 (Poona Herb. !). Nellore Distr. Tada, Feb. 1901 (Bourne 2523 !). Without locality. (Wall. No. 2106, 2106 E). Mysore and Carnatic (Thomson). Ceylon, rather common in the country (Trimen.) Distribution: India, Australia.

Nesaea brevipes Koehne in Engl. Bot. Jahrb. III (1882) 326,in Engl. Pflanzenr. IV, 216 (1903) 226.—*Ammannia cordata* Wight in Wall. Cat. (1828) No. 6322; Wight et Arnott Prodr. I (1834) 304; Clarke in Hook. Fl. Brit. Ind. II (1879) 570; Trim. Fl. Ceyl. II (1894) 225.—*Ammannia salicifolia var. β.* Twait. Enum. Pl. Zeyl. (1864) 121 (*non* Monti).

An annual herb, glabrous; stem 9-37 cm. high, erect, or procumbent at the base and rooting, 4-gonous at the apex, simple or sparingly branched. Leaves 10-35 mm. long, 2.5-10 mm. broad, oblong or obovate, or very rarely lanceolate, acute or obtuse, whitish on the margin.

Dichasia 1-3-flowered; bracteoles about as long as the calyx; calyx broadly campanulate, lobate in fruit, glabrous or minute-hirtellous; lobes half as long as the tube. Petals 0-4, scarcely 1 mm. long; style not quite half the length of the ovary.

Capsule subglobose, or globose, becoming red (contrary to Clarke's statement).

Habitat: Chand District (Duthie No. 9484 !); Ganjam (Gamble No. 13838 !), Kurchiat swamp (Blatter 3393 !). India without precise locality (Wight No. 981 *partim*, 1021, Wallich No. 6322), Ceylon, dry country (Trimen). East Bengal: Noakhali (Clarke).

Distribution: India, Ceylon.

Nesaea triflora Kunth in H., B. et K. Nov. Gen. et Spec. VI (1823) 191 *in adn.*; DC, Prodr. III (1828) 90; Wight Ic. I (1840) t. 259; Koehne in Engl. Bot. Jahrb. III (1882) 330, in Engl. Pflanzenr. IV, 216 (1903) 230.—*Lythrum triflorum* L. f. Suppl. (1781) 249, *excl. loc.*—*Trotula trianthis* Comm. in Herb.—*Ammannia triflora* Wall. Cat. No. 6323 *sec.* Wight and Arn. (*non* R. Br. *et* Benth.)—*Nesaea capitellata* Presl. in Isis XXI (1828) 3.

Quite glabrous. Stem 15-70 cm. high, often rooting at the base, 4-angular. Leaves 10-35 mm. long, 5-13 mm broad, lanceolate or oblong or rarely ovate-oblong, acuminate or obtuse, obtuse at the base or rarely cordate, sub-1-nerved, with a cartilaginous margin.

Dichasia 3-5-flowered, bracteoles of the central flower 2-5 mm. long, about as long as the calyx, lanceolate or linear-subulate, subcymbiform, green, often membranous on the margin. Flower 4-5-, rarely 6-merous. Calyx 3 mm. long, at last semiglobose; lobes $\frac{1}{3}$ the length of the tube; petals rose or lilac, slightly longer than the calyx; stamens 8, 10, (12), the episepalous ones as long as the lobes, or longer by $\frac{1}{3}$, the epipetalous ones shorter than the lobes; ovary ellipsoid-globose, 3-4-locular, style at last twice as long as the ovary.

Capsule globose.

Habitat: Ceylon (Walker). Perhaps introduced.

Distribution: Comoro Islands, Madagascar, Mauritius, Ceylon.

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THE FLORA OF THE INDIAN DESERT, (JODHPUR AND JAISALMER).

BY

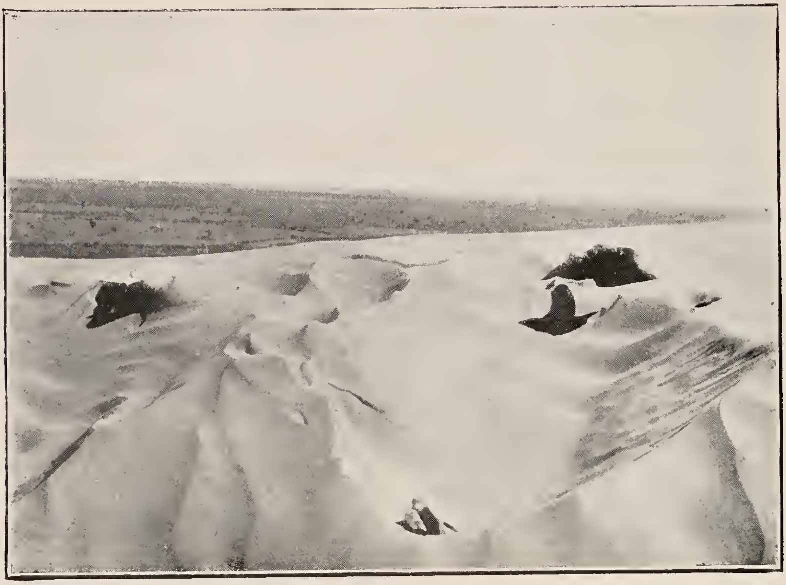
E. BLATTER, S.J. AND PROF. F. HALLBERG.

The Indian Desert is perhaps the least known part of the plains of India. We have seen only two papers dealing with the vegetation of W. Rajputana. One is by G. King, entitled: "Sketch of the Flora of Rajputana." It appeared in the *Indian Forester* IV (1879) 226-236. The other is an "Introductory Note to Jodhpur and Jaisalmer trees and plants." The author and publisher are not mentioned and no date is given. We have been told that Miss Macadam is the author. If we compare the general arrangement of the pamphlet and the treatment of the subject with another paper written by Miss Macadam in 1890, *viz.*, "A list of trees and plants of Mt. Abu," and published at Jodhpur, we think we are right in concluding that to Miss Macadam belongs also the authorship of the former booklet. It contains the vernacular and botanical names, together with short descriptive notes "of trees and plants found during the months of November, December, January and February in the neighbourhood of Jodhpur, also during a march from Balotra to Jaisalmer and a halt there of ten days in December." About 140 species are enumerated. These are the only records of the vegetation of the Rajputana Desert. The vast deserts of N. Africa, Arabia, Central Asia, and even of the New World have attracted the attention of many Botanists, but the Indian Desert has been sadly neglected.

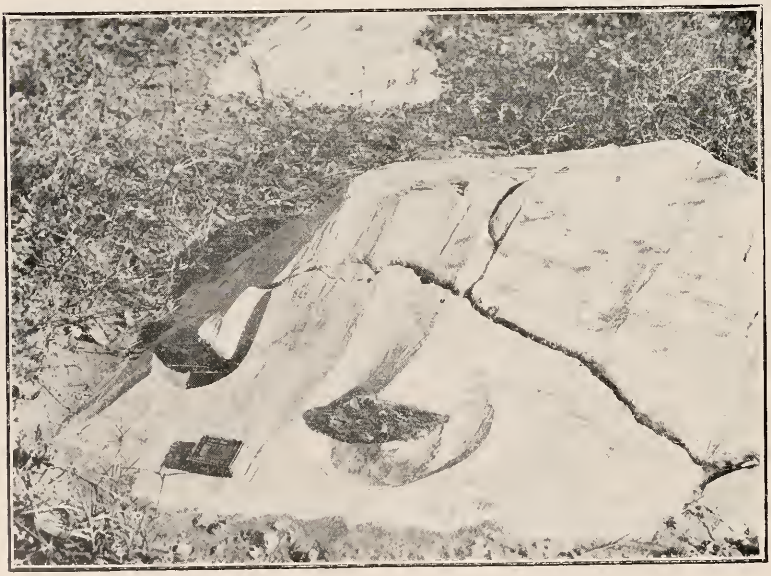
In October and November 1917 we visited a considerable part of W. Rajputana, accompanied by Messrs. T. S. Sabnis, B.Sc., and D. B. Bulsara. We started from Jodhpur, went by train to Phalodi, from there on camel back to Bap, from Bap to Jaisalmer, from Jaisalmer to Barmer, and from Barmer to Luni Junction.

The results of our tour, botanical, geological and meteorological, are laid down in the following pages. Part I will contain a list of the plants with the description of new species, whilst Part II will deal with the ecological side of the flora. Most of the plates appearing in Part I will find their full explanation in Part II.

We wish to use this opportunity to thank the Agent to the Governor-General and Lt.-Col. Kilkelly, I.M.S. (at that time Acting Resident of the W. Rajputana States), who took a keen interest in our work, and also the Durbars of Jodhpur and Jaisalmer for the generous help they gave us throughout our journey.



A.—Wind erosion in sand-dune near Loharki, Jaisalmer State.



B.—Wind erosion in lime-stone, 3 miles S.W. of Phalodi, Jodhpur State.

The Flora of the Indian Desert.

A.—Sand-dune with scanty vegetation at Loharki, Jaisalmer State.

B.—Part of sand-dune devoid of vegetation, showing ripples. In the background the plain near Loharki.

THE FLORA OF THE INDIAN DESERT.

PART I.

MENISPERMACEÆ.

Cocculus DC.

Cocculus cebatha, DC. Syst. I (1818) 527. (=*C. Leæba*, DC.)
Vern. N.: Pilwan (Macadam).
Loc.: Jodhpur: Kailana (No. 5615 !), Mandor (No. 5823 !), Balsamand (No. 5614 !), common in rocky places, often growing in *Euphorbia neriifolia* bushes (Macadam). Jaisalmer: Bada Bag (No. 5616!).
Distrib.: Central and S. Africa, Abyssinia, Kordofan, Eritrea, Nubia, Egypt, Senegambia, Cape Verd Islands, Afghanistan, India.
Fl.: All the year round (Macadam).

Cocculus villosus, DC. Syst. I (1818) 525.
Vern. N.: Bajar bel (Macadam).
Loc.: Jaisalmer State (Macadam).
Distrib: Trop. Africa, India.

NYMPHÆACEÆ.

Nymphaea L.

Nymphæa lotus L. Sp. Pl. (1753) 511.
Vern. N.: Be.
Loc.: Between Seu and Badka in Jodhpur State (Nos. 5774 !, 5825 ! 5826 !).
Distrib.: Africa, Hungary, India, Java, Philippines.
Fl. in Nov.
NOTE: In the same tank we found *Limnanthemum parvifolium*, Griseb., and *Chara sp.*
Uses: Stem and root eaten as a vegetable.

PAPAVERACEÆ.

Argemone L.

Argemone mexicana, L. Sp. Pl. (1753) 508.
Vern. N.: Sattyanasi (Macadam).
Loc.: Very common about villages in Jodhpur State (Macadam). We have not seen the plant which otherwise is spread all over India.
Distrib.: America.
Uses: The yellow juice is used in eye affection and the leaves are given to camels. The juice rubbed on the body releaves rheumatic pain. (Macadam).

Papaver Tourn.

Papaver somniferum, L. The Opium Poppy.
"The poppy is cultivated to a small extent, chiefly in Sojat (Jodhpur State), but opium is not extracted. The seeds are used medicinally and the capsules are soaked in water which, after being strained, is taken as an intoxicant." (Erskine.)

CRUCIFERÆ.

Farsetia Desv.

Farsetia jacquemontii, Hook. f. and Th. in Journ. Linn. Soc. V. (1861) 148.
Vern. N.: Kagpilang.
Loc.: Jodhpur: Jodhpur (No. 7307 !), Mandor (Nos. 7309 !, 5787 !), Bhikamkor (No. 5776 !), Osian (Nos. 7308 !, 5780 !), Balarwa (Nos. 7310 !, 5779 !, 5784 !), Phalodi (No. 5783 !), Kotda near Seu, sand

(No. 5789 !), near Badka (No. 5782 !), Barmer sand (No. 5778 !). Jaisalmer: Vinjorai (No. 5788 !), Devikot (No. 5777 !), Loharki (No. 5786 !) near Loharki, chiefly on sand (No. 7311 !), Shihad (No. 5781 !), Phalodi to Bap, cultivated fields (No. 5835 !).

Distrib.: Rajputana, Sind, N. India, Afghanistan, Baluchistan.

Fl. and fr. in October and November.

Farsetia macrantha, spec. nov.

Suffrutex erectus, rigidus virgatus 75 cm. altus, totus (excepta corolla) coopertus pilis adpressis medio-fixis. Folia integerrima, alterna, conferta in 2/3 inferioribus, late lanceolata, acuta, subcoriacea, usque ad 60 mm. longa et 15 mm. lata, basi attenuata, costa inferne prominente, subsessilia vel 5 mm. attingentia.

Flores in racemis copiosis, laxis; pedicelli fortissimi, ascendentes, 5 mm. longi, gemmis cylindriacis. Calyx cylindriacus; sepala 10-12 mm. longa, 1-1½ mm. lata, linearia, apice subobtusa, posterius necnon anterius minus lata, valde obscure marginata, basi persistentia in fructu, lateralia vero distincte scariose marginata, basi neque indurata nec persistentia. Petala purpurea vel alba, glabra, 14-19 mm. longa, spathulata, in parte latissima 4 mm. attingentia, apice rotunda. Stamina longiora 10 mm. longa, minora 6 mm.; antheræ 3 mm. longæ, fere æquales, lineares, basi subsagittatæ. Pistillum 5 mm. longum; ovarium dense adpressse pilosum, stylo brevi forti.

Siliqua 45 mm. longa, 5 mm. lata, compressissima, obscure stipitata, stylo forti 1 mm. longo munita; stigma album, bilobum, incrassatum in fructu. Valvæ planæ indistincte 1-costatæ, dehiscentes a basi, septo scarioso margine viridi incrassato, conspicue et irregulariter venoso, costa media conspicua sinuata. Semina biseriata, compressa, late alata, madefacta mucilaginea; nucleus brunneo-flavus, 2 mm. diametro; radiculus accumbens.

Differs from the foregoing species by the much larger flowers, larger and differently shaped leaves. From *F. hamiltonii* it may be distinguished by the biseriate seeds. The leaves, the size and shape of the petals and the size of the pod separate the new species from *F. ægyptiaca*, Turr.

A specimen was obtained with much shorter pods, but otherwise identical with the type. Sometimes the pod measures not more than 10 mm. and contains only two seeds. In this case the pod is ovate-acuminate in outline.

Loc.: Barmer, on rocks. (Nos. 7305 !, 7306 !, 5785 !)

Fl. and fr. in November.

The following plants are cultivated:—

Brassica campestris, L. *subsp. napus*. The rape or coleseed.

Vern. N.: Sarson.

NOTE: "Sarson is a cold weather crop, grown on land either attached to wells or irrigated from canals, and in the former event it is sown with wheat. The ordinary outturn is about six cwt. per acre, and the seed yields an oil which is used for cooking purposes." (Erskine.)

Brassica oleracea, L. *var. botrytis*. The cauliflower.

Raphanus sativus, L. The radish.

CAPPARIDACEÆ.

Cleome L.

Cleome papillosa, Steud. Nomen. ed. 2, I (1840) 382.

Loc.: Jodhpur: Kailana (Nos. 5702 !, 5701 !), Mandor (No. 5707 !) Bhikamkor (No. 5750 !), near Badka (No. 5706 !), Barmer (No.

5699!). Jaisalmer: Loharki (No. 5709 !), Bap (Nos. 5703 !, 5705 !), Sodakoer, dried-up river bed (No. 5704 !), Amarsagar (No. 5700 !), Jaisalmer, on rocks (No. 5708 !), Vinjorai, on rocks (No. 5751 !).
Distrib.: Rajputana, Sind, Arabia, Abyssinia, Nubia, Kordofan.
Fl. and fr. in October and November.

Cleome brachycarpa, Vahl. ex DC. Prodr. I (1824) 240.
Vern. N.: Nodi (Macadam), Navli.
Loc.: Jodhpur: Kailana (Nos. 5713 !, 5722 !, 5719 !), Mandor (No. 5714!), Bhikamkor, common on sand dunes (No. 5718 ! , 5721 !), near Badka (No. 5717 !), Phalodi (No. 5712 !), Balarwa (No. 5710 !). Jaisalmer: Jaisalmer (No. 5720 !), Bada Bag (No. 5711 !), Vinjorai, sandy plain (No. 5716 !), near Bap (No. 5715 !).
Distrib.: Punjab Plains, Sind, westward to Arabia, Abyssinia and N. Africa.
Fl. and fr. in October and November.
Uses: Used to cure worms in camels' noses (Macadam).

Cleome brachycarpa var. glauca var. nov. Folia 3-foliolata, infra et supra pallide glauca, glabra excepto margine glanduloso-pubescente, petiolus longior typo usque ad 13 mm. attingens. Rami glaucescentes foliis paulisper pallidiores. Semina minuto-reticulata.
Loc.: N. of Jaisalmer, rocky plateau (No. 5753 !).
Fl. and fr. in November.

Cleome viscosa L. Sp. Pl. (1753) 672.
Loc.: Jodhpur: Balsamand (No. 5726 !), Kailana (No. 5731 !), Bhikamkor (Nos. 5725 !, 5723 !), Balarwa (No. 5724 !), Barmer, rocks (No. 5729 !). Jaisalmer: Between Phalodi and Bap (No. 5727 !), Amarsagar (No. 5728 !), Bada Bag (No. 5730 !).
Distrib: Throughout the tropical regions of the world.
Fl. and fr. in October and November.

GYNANDROPSIS DC.

Gynandropsis pentaphylla, DC. Prodr. I (1824) 238.
Vern. N.: Bagra (Macadam).
Loc.: Jodhpur: Jodhpur (No. 5698 !), very common at Jodhpur where it comes up in great quantities along the roadsides and fields during the rains (Macadam), Balarwa, cultivated ground and gravel (No. 5734 !), Osian (No. 5735 !), Bhikamkor (No. 5737 !), Seu (No. 5738 !), Barmer, on gravel (No. 5740 !). Jaisalmer: Bada Bag (No. 5732 !), Jaisalmer, wet ground (No. 5736 !), Bap (No. 5733 !), Vinjorai (No. 5739 !).
Distrib.: A common weed in all tropical countries.
Fl. and fr. in October and November.

Uses: The seeds infused in boiling water are used as a cure for coughs, bruised they are applied as a poultice to sores that have maggots in them. The green leaves applied to the skin and tied down form a good blister (Macadam). The seeds are given to horses against stomach ache, the leaves are used against rheumatism in man.

Gynandropsis pentaphylla var. nana var. nov.—Alta 11 cm. Folia glaberrima exceptis aliquibus glandulis stipitatis in margine. Petala 5 mm. longa.
Loc.: Jaisalmer: Vinjorai (No. 5741 !).
Fl. and fr. in November.

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Cadaba Forsk.

Cadaba indica, Lam. Encycl. I (1783) 544.

Vern. N.: Dabi (Macadam).
Loc.: Jodhpur: Mandor, growing in *Euphorbia* bush (No. 5744!), in hedges and waste places about Jodhpur, not common (Macadam), Barmer (No. 5743!, 5742!).
Distrib.: Concan, Deccan, Gujarat, Rajputana.
Fl. in October and November.
NOTE:—Seems to be a rare plant in Rajputana.

Capparis L.

Capparis decidua, Pax., in Engl. Prantl Nat. Pflanzenf. III, 2,231.—*Sodada decidua* Forsk. Fl. Aeg. Arab. (1775) 81.—*Capparis aphylla*, Roth. Nov. Pl. Sp. (1821) 238. *Capparis sodada*, R. Br., in Denh. Trav., 255.
Vern. N.: Kair (in Jodhpur), Ban (in Jaisalmer), (Macadam).
Loc.: Jodhpur: Kailana (No. 5748!), Balsamand (No. 5745!), Barmer (No. 5747!).
Jaisalmer: Vinjorai (No. 5746!).
Distrib.: Trop. Africa, Arabia, India.
Fl. in October.
NOTE:—Very common in sandy places, associated with the small *Zizyphus rotundifolia*, Lam., *Leptadenia spartium*, and *Aerua tomentosa*.
Uses: Wood very strong and durable, used to make the pivots of the stone hand mills with which flour is ground. In sandy places it is used to make the foundation of well-walls, the first layer being formed with Kair, and the masonry built on the top of it. Branches used for fences. Fruit eaten, dried and pickled (Macadam). The wood is valuable because it is not attacked by white ants.

Capparis spinosa, L. Sp. Pl. (1753) 503.
Loc.: Western Rajputana (King).
Distrib.: Mediterranean region, N. Africa, Asia, Australia.

Capparis sp.
Loc.: Jaisalmer: Amarsagar gardens, probably introduced.

Capparis grandis, L. f. Suppl. (1781) 263.
Vern. N.: Antera.
Loc.: W. Rajputana (Duthie).
Distrib.: India.
Uses: An infusion of the bark and leaves is used internally for swellings and eruptions (Macadam).

VIOLACEÆ.

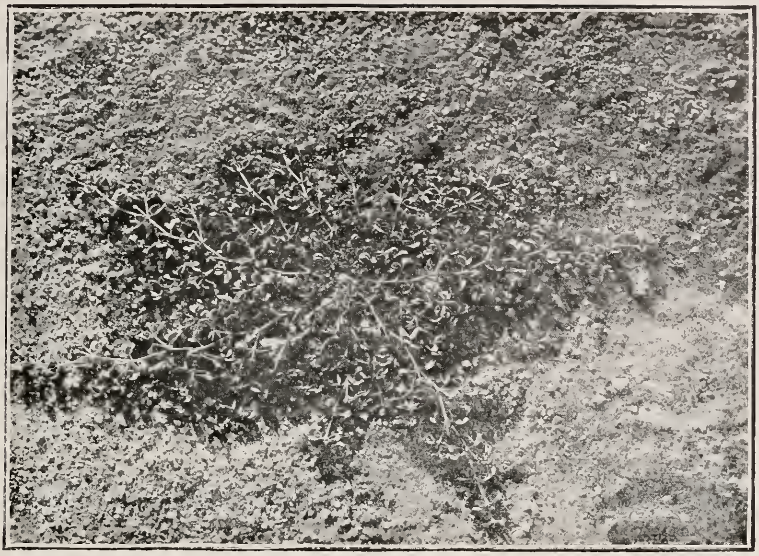
Viola L.

Viola stocksii, Boiss. Fl. Or. I (1867) 453.
Loc.: Jodhpur: Kotda near Seu, rocks (No. 6716!), Barmer, rocks (No. 6717!). Jaisalmer on rocks (No. 6718!).
Distrib.: Gujarat, Rajputana, Sind, Baluchistan, Afghanistan.
Fl. and fr. in November.
NOTE:—All the flowers are apetalous. The whole plant is generally puberulous, the leaf-margins often papillose. The stipules partly scarious.

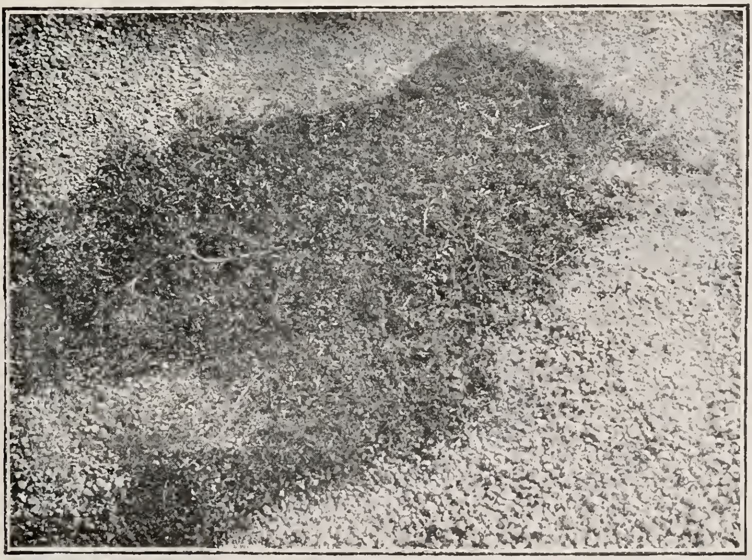
A.—Jodhpur City and neighbouring hills as seen from the Fort.

B.—View of Jaisalmer Town and surrounding plain, taken at the Guest House.

THE FLORA OF THE INDIAN DESERT.



A.—A typical gravel-plant: *Seetzenia orientalis*, Dcne, in flower and fruit.



B.—Another member of the gravel-vegetation: *Corchorus antichorus*, Raeusch, forming dense mats lying flat on the ground.

The Flora of the Indian Desert.

POLYGALACEÆ.

Polygala L.

Polygala erioptera, DC. Prodr. I (1824) 326.

Vern. N. : Chota bhekaria.

Loc. : Jodhpur: Jodhpur (Nos. 6883!, 6886!), Kailana (Nos. 6897!, 6888!), Mandor (No. 6892!), Balsamand (Nos. 6893!, 6894!), Osian (Nos. 6885!, 6891!), Phalodi (No. 6905!), Bhikamkor (No. 6906!), Barmer rocks (Nos. 6884!, 6887!, 6907!, 6910!), near Badka (No. 6911!), Kotda, rocks (No. 6898!). Jaisalmer: Between Phalodi and Bap (No. 6902!), 10 miles W. of Bap (No. 6890!), Sodakoer (No. 6899!), Sodakoer, river bed (Nos. 6900!, 6901!), Loharki (No. 6903!), Bada Bag (No. 6904!), Jaisalmer, rocky plateau (No. 6889!), Vinjorai, rocks (Nos. 6896!, 6895!).

Distrib. : Trop. Asia, Arabia, Africa.

Fl. and fr. in Oct. and Nov.

NOTE :—Cooke (Fl. Bomb. Pres. I, 60) says the flowers of this species are yellow. Our specimens have pale rose-coloured flowers, with the tip of the keel-petal and the crest darker. There is little doubt that our specimens belong to the same species as Cooke's, and we have consequently placed them under *P. erioptera*, though provisionally. We add the following characters to Cooke's description.

Wings often obovate, generally rounded at the tip, sometimes with a minute mucro, rarely subacute or distinctly acute; colour pale green or pale greenish rose, midrib always strong, green.

Seeds greyish or brownish, covered with long, white, greyish or brownish hairs, except at both ends. Strophiole galeate, with a dorsal ridge and two lateral flaps, the former mainly white, glistening, the latter generally yellow. In the angles on both sides of the ridge there is a brown line. At the top of the helmet on each of these lines there is generally a tuft of hairs, the whole structure otherwise being smooth and shining. At the opposite end of the seed there is a small tuft of very minute pure white hairs, visible only when the seed is held vertically, since the long hairs covering the greater part of the seed project beyond the seed.

Polygala irregularis, Boiss. Diagn. (1842) fasc. 1, p. 8.

Loc. : Jodhpur : Bhikamkor (No. 6914!), Balarwa (Nos. 6920!, 6916!), Mandor (Nos. 6921!, 6923!, 6918!), Osian (Nos 6919!, 6922!), Kotda. sand (No. 6924!). Jaisalmer : Shihad (No. 6925!), Jaisalmer, rocky plateau (No. 6917!), Jaisalmer, gravel (No. 6912!), Vinjorai, dunes (Nos. 6913!, 6915!). Very common.

Distrib. : India, Baluchistan, Arabia, Kordofan.

Fl. and fr. in Oct. and Nov.

NOTE :—We add a few corrections and additions to Cooke's description (Fl. Bomb. Pres. I, 61).

The outer sepals broadly oblong, rounded at the tip, minutely ciliolate. Sepals otherwise glabrous, scarious, pale greenish or rose. with conspicuous green or purplish veins. Wings oblique.

Margin of capsule transversely nerved (not striate). Seeds, when ripe, nearly black, shining, very minutely punctate, hairy all over. Near the hilum a tuft of rather long stiff hairs A ring of similar hairs round the truncate end. The intermediary region covered with very short stiff hairs. The apex is clothed with a dense carpet of minute clavate transparent hairs. Hairs nearly white to brownish grey. It is the part of the seed near the hilum that is very acute. There are two small, spreading yellowish appendages near the hilum, united at the base, reaching 1/3 the length of the seed.

Miss Macadam and King mention *P. abyssinica* as occurring in W. Rajputana. As we have not found it anywhere we are afraid that there must have been some mistake in the identification of the plant.

CARYOPHYLLACEÆ.

Polycarpæa Lam.

Polycarpæa corymbosa, Lam. Tab. Encycl. Meth. II (1800) 129.

Vern. N.: Zutaniakhad.

Loc.: Jodhpur: Jodhpur (No. 6868 !), Mandor (No. 6872 !), Bhikamkor (No. 6880 !), Osian (No. 6881 !), Balarwa, fields (No. 6882 !), Barmer, sand (Nos. 6879 !, 6878 !), Kotda, sand (No. 6874 !), near Badka (No. 6870 !). Jaisalmer: Jaisalmer, rocky plateau (No. 6869 !), Shihad, gravel (No. 6871 !), Vinjorai, dunes (Nos. 6873 !, 6875 !), Devikot (Nos. 6876 !, 6877 !).

Distrib.: In the tropics generally.

Fl. and fr. in Oct. and Nov.

Saponaria L.

Saponaria vaccaria, L. Sp. Pl. (1753) 409.

Loc.: W. Rajputana, a weed of cultivation (King).

Distrib.: Temperate and subtropical countries.

PORTULACACEÆ.

Portulaca L.

Portulaca oleracea, L. Sp. Pl. (1753) 445.

Loc.: Jodhpur: Mandor (No. 6730 !), Jodhpur (No. 6740 !). Jaisalmer: Between Phalodi and Bap (No. 6731 !), Bap (No. 6741 !), near Loharki (No. 6742 !), Amarsagar (No. 6743 !), Bada Bag (No. 6723 !), Jaisalmer, wet ground (No. 6728 !), Vinjorai (No. 6729 !), near Devikot (No. 6727 !).

Fl. and fr. in Oct. and Nov.

Portulaca quadrifida, L. Mantiss. (1767) 73.

Vern. N.: Lunki.

Loc.: Jodhpur: Mandor (No. 6733 !), Balsamand (No. 6722 !), Bhikamkor (No. 6734 !), Osian (No. 6725 !), Barmer, sand (No. 6735 !), Barmer rocks (No. 6719 !), Kotda near Seu (No. 6720 !). Jaisalmer: N. of Jaisalmer (No. 6710 !), Amarsagar (No. 6726 !), Bada Bag (Nos. 6721 !, 6724 !).

Distrib.: Trop. Africa and Asia.

TAMARICACEÆ.

Tamarix L.

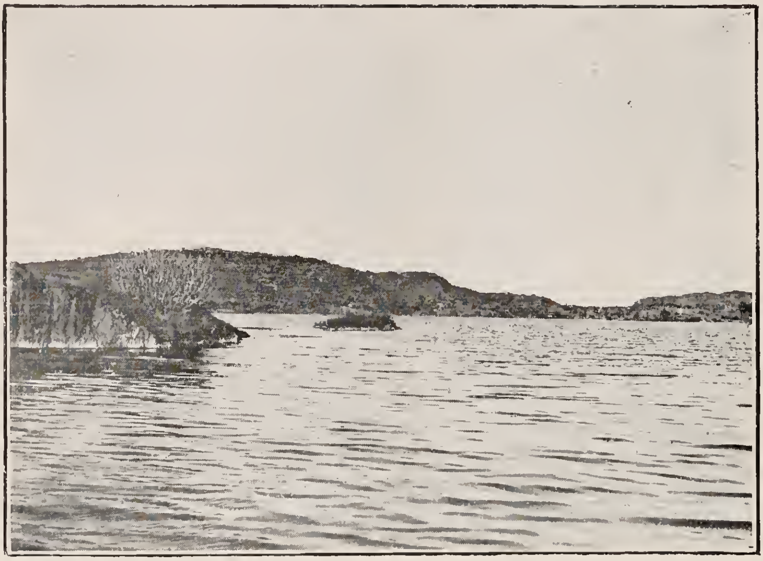
Tamarix dioica, Roxb. Hort. Beng. (1814) 22.

Loc.: Jodhpur: Balsamand (No. 5887 !), in the salt-impregnated bed of the Luni (King).

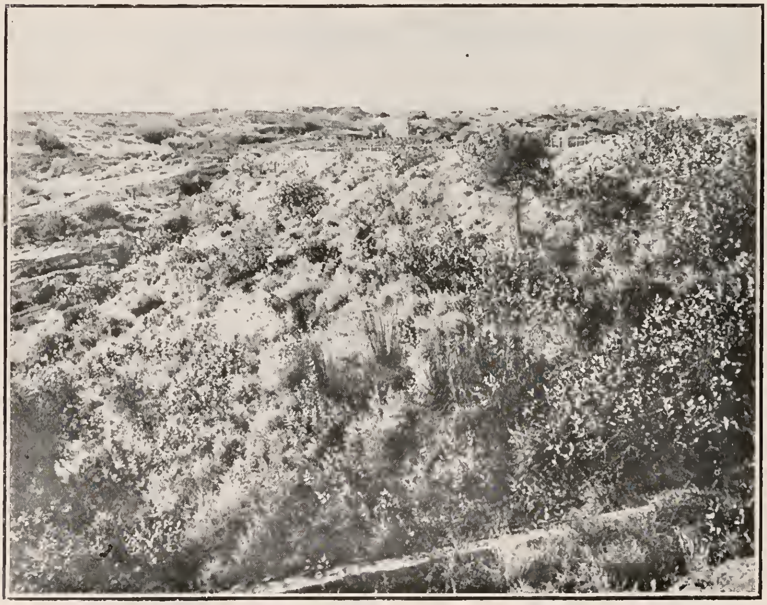
Distrib.: India.

Tamarix orientalis, Forsk. Fl. Aeg. Arab. (1775) 206. *Tamarix articulata*, Vahl. Symb. II (1791) 48, t. 32.

Vern. N.: Faras.

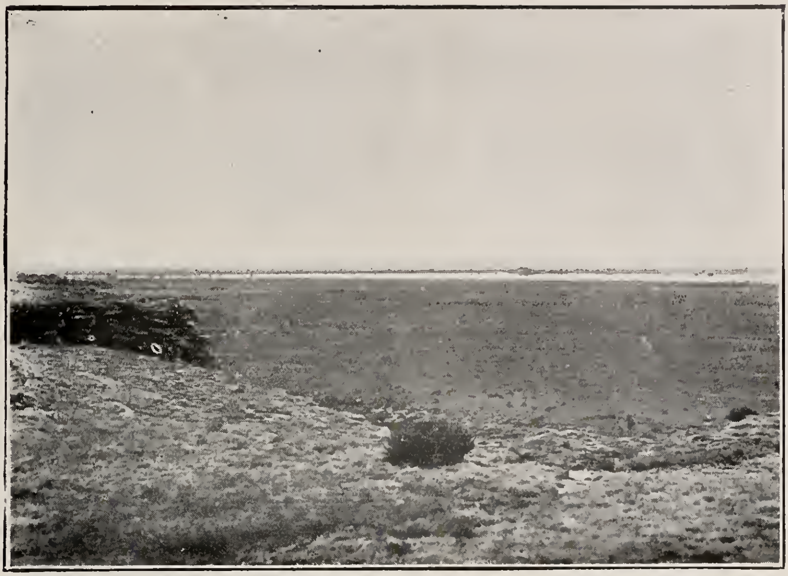


A.—Kailana Lake near Jodhpur. Rocky shore with *Euphorbia* vegetation.

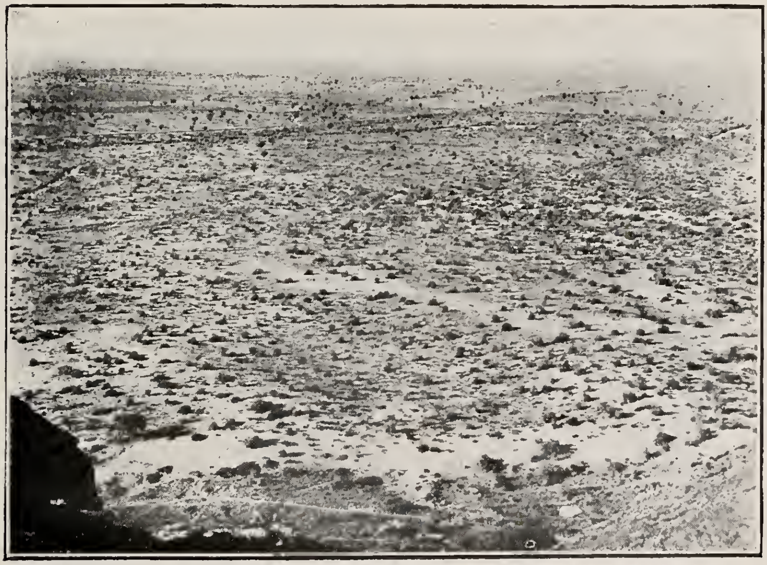


B.—Kailana Lake Dam exhibiting a varied vegetation owing to the percolation of water: *Calotropis procera*, *Aerua tomentosa* and numerous high grasses.

THE FLORA OF THE INDIAN DESERT.



A.—General view of country near Mandor (Jodhpur State). In the foreground a rocky plateau with *Euphorbia neriifolia*, L. In the sandy plain between the plateau and the lake: *Crotalaria burhia, Leptadenia spartium, Aerua sp.*



B.—Plain near Jodhpur, showing small trees and scrub vegetation: *Leptadenia spartium, Prosopis spicigera, Acacia arabica, Aerua tomentosa,* etc.

The Flora of the Indian Desert.

Loc. : Jodhpur: Phalodi (Nos. 5885 !, 5886 !). Jaisalmer: Bap (No. 5884 !).

Distrib : Punjab, Sind, Afghanistan, Arabia, North, Central and South Africa.

Tamarix gallica, L. Spec. Pl. (1753) 270.

Vern. N. : Imli (Macadam).

Loc. : Jaisalmer State (Macadam). Jodhpur: In the salt-impregnated bed of the Luni (King).

Distrib. : Mediterranean region, N. and trop. Africa, India, S. Asia.

Uses : The seeds are roasted and eaten by the poor instead of the betel nut and are much liked by women. Boys gamble with them. Sherbet made from the fruit is very beneficial in cases of "Looh" (fever brought on from exposure to the hot wind). The shade of the tree is supposed to be injurious to health. A heated traveller resting beneath its shadow is said to suffer afterwards from fever or rheumatism, and popular superstition avers that the tree is always haunted by some ghost, whose purpose is to scare away the unwary (Macadam).

ELATINACEÆ.

Bergia L.

Bergia ammannioides, Roxb. Hort. Beng. (1814) 34.

Loc. : Jodhpur: Kailana (Nos. 5764 !, 5762 !), 25 miles S. E. of Luni (No. 5773 !), Mandor (Nos. 5771 !, 5772 !). Jaisalmer: Vinjorai (No. 5769 !), Jaisalmer, wet ground (No. 5768 !), N. of Jaisalmer (No. 5763 !), Amarsagar (No. 5766 !), between Phalodi and Bap (No. 5767 !), near lake between Phalodi and Bap (No. 5770 !), Devikot (No. 5765 !).

Distrib. : Konkan, Deccan, Sind, Abyssinia, Nubia, Senegambia, Australia.

Fl. and fr. in October and November.

Bergia odorata, Edgew. in Journ. Asiat. Soc. Beng. VII (1838) 765.

Vern. N. : Kakria, Karbuja, Rohwan (Macadam).

Loc. : Jodhpur: Balarwa (No. 5754 !), Kailana (No. 5755 !), Phalodi near lake (No. 5761 !). Jaisalmer: Jaisalmer, rocky plateau (No. 5760 !), Vinjorai, near lake (No. 5756 !), Devikot (No. 5757 !), between Phalodi and Bap, gravel (Nos. 5758 !, 5697 !), Loharki (Nos. 5696 !, 5759 !), common near cultivated places (Macadam).

Distrib. : Trop. Africa, Egypt, Persia, Sind, Gujarat.

Fl. and fr. in October and November.

NOTE : The petals are white, the style purple.

Uses : Used for cleaning teeth and, in Jodhpur, applied to broken bones. The leaves rubbed down in water are used as a poultice for sores (Macadam).

Bergia æstivosa, W. & A. Prodr. 41.

Loc. : Western Rajputana (King).

Distrib. : Punjab, Rajputana.

MALVACEÆ.

Sida L.

Sida spinosa, L. Sp. Pl. (1753) 683.

Loc. : Jodhpur: Jodhpur (No. 5638 !), Mandor (No. 5619 !), 25 miles N. E. of Luni (No. 5639 !), Kotda near Seu (No. 5622 !). Jaisalmer: Bada Bag (No. 5640 !), Loharki (No. 5623 !).

Distrib.: Trop. and sub-trop. regions of both hemispheres.

Fl. and fr. in October and November.

Note: White, pale yellow and yellow flowers have been observed.

Sida grewioides, Guill. Perr. et A. Rich. Fl. Seneg. I (1830) 71.

Vern. N.: Ball, Dabi (*ex* Macadam).

Loc.: Jodhpur: Kailana (No. 5629!), Balarwa (No. 5637!), Phalodi (No. 5627!), Bhikamkor (Nos. 5617!, 5630!, 5631!), Kotda near Seu, on rocks (No. 2953!). Jaisalmer: Jaisalmer (No. 5635!), on rocky plateau (No. 5626!), Bada Bag (No. 5634!), Amarsagar (Nos. 5620!, 5628!), Loharki (Nos. 5625!, 5618!), Vinjorai (No. 5632!), Vinjorai, sandy plain (No. 5624!), Vinjorai on rocks (No. 5636!), from Jaisalmer to Devikot (No. 5633!), Devikot (No. 5621!). Common about gardens and cultivated places (Macadam).

Distrib.: Punjab, Sind, Baluchistan, extending to Arabia and trop. Africa.

Fl. and fr. in October and November.

Note: According to Hooker the flowers are yellow, whilst Cooke says they are white. We have seen both, but yellow seems to be more common.

Uses: The seeds ground and mixed with goor are used as a cure for lumbago (Macadam).

Sida cordifolia, L Sp. Pl. (1753) 684.

Loc: Jodhpur: Osian (No. 5641!), Balarwa (No. 5642!).

Distrib.: Trop and sub-trop. regions of both hemispheres.

Fl and fr. in October and November.

Uses: This plant, yielding an excellent fibre, might be grown with advantage in some parts of Rajputana.

Abutilon Tournef.

Abutilon indicum, Sw. Hort Brit. I (1827) 54.

Vern. N.: Dabi, jhili, tara kanchi (Macadam).

Loc.: Jodhpur: Jodhpur Fort (No. 5649!), Mandor (No. 5647!), common about gardens in Jodhpur State. Jaisalmer: Amarsagar (Nos. 5648!, 5650!).

Distrib.: Hotter parts of India and throughout the tropics generally.

Fl. and fr. in October and November.

Uses: From the stems a strong fibre is obtained. The seeds infused in hot water form a cooling drink.

Abutilon indicum var. maior var. nov.—Folia multo largiora, 20 cm. longa, 17 cm. lata, petiolo 17 cm. longo.

Loc.: Jaisalmer: Amarsagar, in ruderatis (No. 5644!).

Fl. and fr. in November.

Abutilon asiaticum, G. Don., Gen. Syst. I (1831) 503.

Loc.: Jaisalmer: Amarsagar (No. 5657!).

Fl. and fr in November.

Distrib.: Tropics of both hemispheres.

Uses: The stems yield a good fibre.

Abutilon muticum, Sw. Hort. Brit. ed. 2 (1830) 65.

Vern. N: Pintari (Macadam).

Loc: Jodhpur: Jodhpur (No. 5661!), Balsamand, not very common (Macadam). Kotda near Seu (No 5651!) Jaisalmer: Near Bap (No. 5645!), Gharsisar Tank near Jaisalmer (No. 5646!), Amarsagar (No. 5691!).

Distrib.: India, Afghanistan, Egypt, Trop. Africa.

Fl and fr. in October and November.

Abutilon bidentatum, A. Rich. Fl. Abyss. I (1847) 68.

Vern. N.: Rota vel.

Loc.: Jodhpur: Balarwa (No. 5663 !), between Seu and Bhadka (Nos. 5664 !, 5665 !). Jaisalmer: Bada Bag (No. 5663).
Distrib.: India, Arabia, trop. Africa.
Uses: Flowers eaten by children.

Abutilon fruticosum, Guill. Perr. et- A. Rich. Fl. Seneg. I (1830) 70.
Loc.: Jodhpur: Kotda near Seu (No 5653 !), Barmer (No. 5666 !). Jaisalmer: Bada Bag (No. 5659 !), W. of Bap (No. 5643 !), Sodakoer in riverbed (No. 5658 !).
Distrib.: Trop. Africa, Arabia, India, Java.

Abutilon fruticosum var. chrysocarpa var. nov.—Fructus coopertus pubescentia stellari aurea.
Loc.: Jaisalmer: Vinjorai, on rocks (No. 5660 !).
Fl. and fr. in November.

Abutilon cornutum, T. Cocke. Fl. Bomb. Pres. I (1903) 98.
Loc.: Jodhpur: Kailana (No. 5654 !), Mandor (No. 5662 !), Bhikamkor (No. 5655 !). Jaisalmer: Amarsagar (No. 5656 !).
Distrib.: Sind, Rajputana.
Fl. and fr. in October and November.

Pavonia Cav.

Pavonia arabica, Steud. Nom. ed. 2, II (1841) 279.
Loc.: Jodhpur: Barmer (No. 5670 !), Osian (No. 5671 !), Kotda near Seu on rocks (No. 5684 !).
Distrib: Rajputana, Sind, Abyssinia.
Fl. and fr. in October and November.

Pavonia arabica var. glutinosa var. nov.—Planta tota cooperta densa pubescentia viscosa.
Loc: Jodhpur: Barmer, on rocks (No. 5685 !) Kailana (Nos. 5669 ! 5668 !). Jaisalmer: Bada Bag (No. 5667 !).
Fl. and fr. in October and November.

Pavonia zeylanica, Cav. Diss. III (1787) 134, t. 48, fig. 2.
Loc.: Jodhpur: Bhikamkor (No. 5683 !), Barmer (No. 5672 !).
Distrib.: India, Ceylon, Mauritius, Trop. Africa.
Fl. and fr. in October and November.

Pavonia odorata, Willd. Sp. Pl. III (1800) 837.
Vern. N.: Chirike nahl (Macadam).
Loc.: Jodhpur: Kailana (Nos. 5687 !, 5673 !).
Distrib.: India, Ceylon, trop. Africa.
Fl. and fr. in October.

Hibiscus L.

Hibiscus micranthus, L. f. Suppl. (1781) 308.
Loc.: Jodhpur: Kailana (No. 5695 !), Kotda near Seu (No. 5682 !). Jaisalmer: Jaisalmer on rocks (No. 5674 !), on rocky plateau (No. 5680 !), Vinjorai on rocks (5675 !).
Distrib.: India, Ceylon, trop. Africa.
Fl. and fr. in October and November.

Hibiscus abelmoschus, L. Sp. Pl. (1753) 696.
Loc.: Jodhpur: Barmer, on rocks (No. 5681 !). Jaisalmer: Bada Bag (Nos. 5677 !, 5676 !).
Distrib.: Tropics of the Old World.
Fl. and fr in November.

Hibiscus esculentus, L. Sp. Pl. (1753) 696.
Loc.: Jodhpur: Balarwa (No. 5678 !). Jaisalmer: Amarsagar (No. 5679 !).
Distrib.: Probably African, and naturalized in India.
Fl. and fr. in October and November.

Hibiscus cannabinus, L. Syst. Nat. (1759) [1149].
Vern. N.: Ambari.
Loc.: Jodhpur: On the edges of cotton fields (Erskine).
Distrib.: Cultivated in most trop. countries.
Uses: "The crop is cut in November or December, the yield being about six cwt. of clean fibre to the acre. The plants are tied up in bundles, and in May or June, when ropes are required, are soaked in water; when sufficiently moistened, the bark is stripped off and the stems are used as fuel." (Erskine.)

Gossypium L.

Gossypium herbaceum, L. Spec. Pl. (1753), 693, *var.*
Vern. N.: Kapas.
Loc.: Jodhpur: Near Badka (No. 5693 !), Balarwa (No. 5688 !). Jaisalmer: Amarsagar (No. 5692 !), Jaisalmer (No. 5691 !)
Fl. and fr. in October and November.

Gossypium arboreum, L. Sp. Pl. (1753) 693.
Loc.: Jaisalmer: Bap (No. 5689 !).
Fl. in October.
NOTE: We have not been able to ascertain what species are under cultivation. Cotton is grown chiefly in Bali, Desuri, Bilara, Mallani, and Merta (all in Jodhpur State).

STERCULIACEÆ.

Melhania Forsk.

Melhania denhami, R. Br. in Denh. and Clapp. Trav. (1826) App. 232.
Loc.: Kotda near Seu (No. 2952 !), Barmer, rocks (Nos. 7293 !, 7291 !), Jaisalmer: Vinjorai, dunes (No. 7289 !), Loharki (Nos. 7288 !, 7287 !, 7290 !, 7292 !, 7294 !).
Distrib: Rajputana, Sind, Baluchistan, Arabia, Trop. Africa.
Fl. and fr. in November.

Melhania tomentosa, Stocks. *var. maior var. nov.* Folia 10 cm. attingentia, petiolus 22 mm. longus.
Loc.: Jodhpur: Barmer, rocks (Nos. 7286 !, 7295 !, 7296 !).
Distrib.: Gujarat, Rajputana, Punjab, Sind.
Fl. and fr. in November.

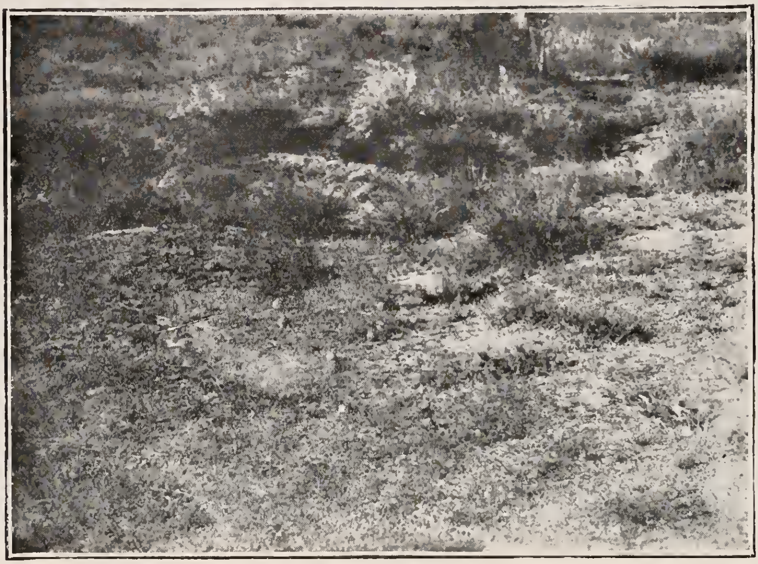
Melhania magnifolia, spec. nov.

Frutex humilis. Caulis ramique tomentoso-canescentes. Folia ovato-oblonga vel ovato-lanceolata, apice obtusa vel subacuta, vel acuta, dense et molliter tomentosa, facie ventrali virescentia, dorsali albida, margine irregulariter crenato vel dentato-crenato, vel dentato, basi cordata 7-nervata, usque ad 11 cm. longa, 5 cm. lata. Petiolus tomentosus, colore faciei inferioris foliorum, 30 mm. attingens. Stipulæ subulatæ, tomentosæ, 12 mm. longæ, caducæ.

Pedunculi axillares vel terminales, cinereo-tomentosi, 5 cm. attingentes, recti, 5-1-flori. Pedicelli fortes, 13 mm. attingentes. Bracteolæ 3, persistentes, cordatæ, late ovatæ, acuminatæ, dense cinereo-tomentosæ facie dorsali et ventrali, sepalis subbreviores vel iis æquilongæ, 20 mm. longæ, 10 mm. latæ. Calyx 5-partitus; sepala lanceolata, cuspidata, dense tomentoso-villosa. Corolla aurantiaco-flava, sepalis tertio ($\frac{1}{3}$) longior, circa 24 mm. longa.

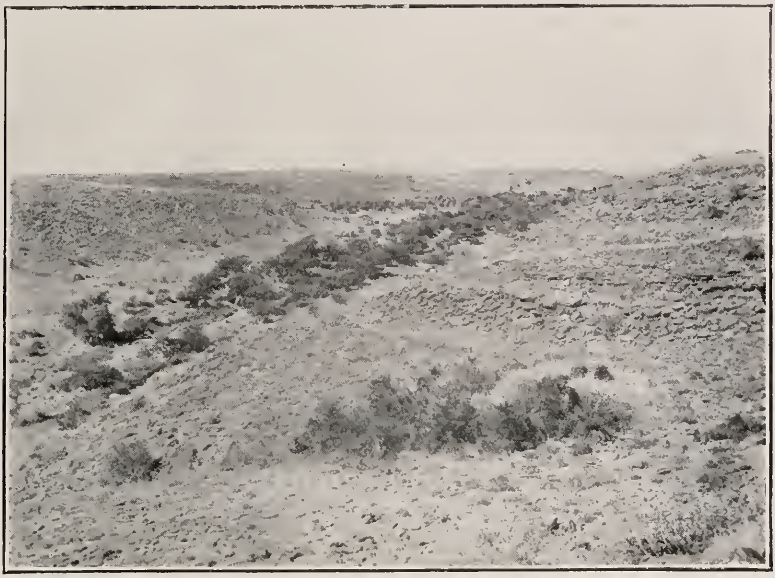
Capsula subglobosa, 15 mm. diametro, dense tomentosa, calyce subbrevior.

Loc.: Jodhpur: Kailana (Nos. 7285 !, 7279 !), Osian (No. 7280 !).

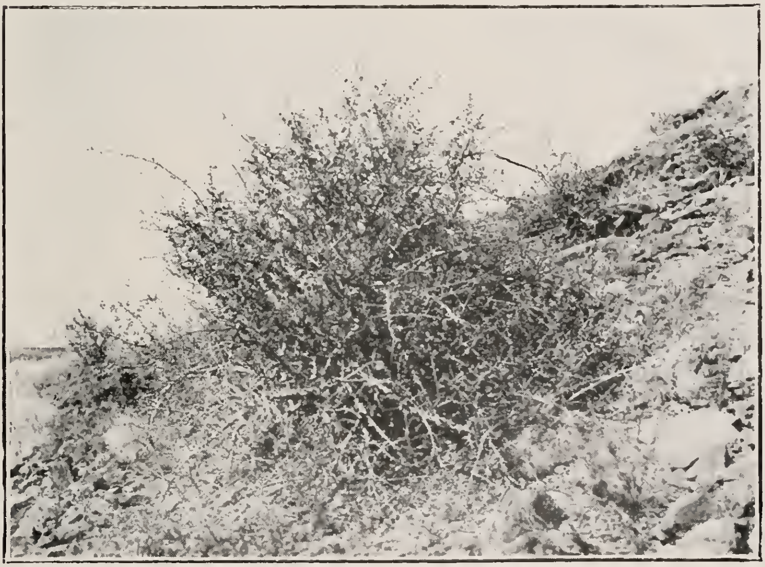


A.—Sandy plain, 3 miles E.N.E. of Jaisalmer Town. In the foreground fruiting specimens of *Citrullus colocynthis*, with shoots up to 50 ft. long.

B.—A consocies of *Indigofera argentea*, Burm. on a sand-dune, 3 miles S.W. of Phalodi (Jodhpur State).



A.—A depression in rocky country, 6 miles N.E. of Jaisalmer Town, with *Prosopis spicigera*, *Salvadora oleoides*, *Gymnosporia montana*. In the foreground : *Commiphora mukul*. *Sarcostemma brevistigma*.



B.—Shoot-habit of *Commiphora mukul* on rocky slope of the above locality.

Melhania hamiltoniana, Wall. Pl. As. Rar. I, t. 77.
Loc. : W. Rajputana (King).
Distrib. : India.

TILIACEÆ.

Grewia L.

Grewia populifolia, Vahl. Symb. I (1790) 33.
Vern. N. : Gangi (Macadam gives the names Gangeran and Kankeran).
Loc. : Jodhpur : Balsamand (No. 5899 !)), Kailana (No. 5907 !), Barmer, rocks (No. 5904 !). Jaisalmer : Vinjorai, dunes (No. 5906 !), Devikot (No. 5904 !), Jaisalmer (No. 5903 !), Amarsagar (No. 5902 !), Jaisalmer, rocky plateau (No. 5900 !).
Distrib. : Trop. Africa, Arabia, S. Persia, Afghanistan, Baluchistan, Sind, S. M. Country, Ceylon, Mauritius.
Fr. in October and November. A few flowers have been noted during the same time.
Uses : Fruit eaten. Walking sticks are made from the wood, and pencils for writing on the boards covered with sand, which are used in schools instead of slates (Macadam).

Grewia salvifolia, Heyne ex Roth. Nov. Pl. (1821) 239.
Loc. : Jodhpur : Kailana (No. 5908 !).
Distrib. : Trop. Africa, India,

Grewia villosa, Willd. in Ges. Naturf. Fr. IV (1803) 205.
Vern. N. : Lonkas.
Loc. : Jodhpur : Balsamand (Nos. 5912 !, 5895 !), Kailana (No. 5914 !), Barmer, rocks (Nos. 5891 !, 5913 !), Kotda near Seu, on rocky ground (No. 5911). Jaisalmer : Bada Bag (No. 5896 !).
Distrib. : Trop. Africa, India.
Uses : The fruit is eaten.

Grewia abutilifolia, Vent. ex Juss. in Ann. Mus. Par. IV (1804) 92.
Vern. N. : Gangeti.
Loc. : Jodhpur : Near Badka (No. 5898 !), Barmer, rocks (Nos. 5910 ! 5897 !). Jaisalmer : Vinjorai, sand dunes (No. 5909 !).
Distrib. : India, Java.

Corchorus L.

Corchorus olitorius, L. Sp. Pl. (1753) 529.
Loc. : Jaisalmer : Bada Bag (No. 5888 !), Amarsagar (No. 5916 !).
Distrib. : All tropical regions.
Fr. in November.

Corchorus trilocularis, L. Mant. (1767) 529.
Vern. N. : Hardikeket, Karak, Kaglekitamaku (Macadam).
Loc. : Jodhpur : Barmer (No. 5925!). Jaisalmer : Jaisalmer (No. 5949 !), Amarsagar (No. 5924!), Devikot (No. 5945 !), Bap (5946 !), Vinjorai, on rocks (5947 !), Vinjorai, on gravel (No. 5948 !).
Distrib. : Trop Africa, Afghanistan, India.
Fr. in November.

Corchorus fascicularis, Lam. Encycl. II (1786) 104.
Loc. : Jodhpur : Balarwa (Nos. 5890 ! , 5593 !). Jaisalmer : Bada Bag (No. 5889 !).
Distrib. : Trop. Africa, India, Ceylon, Australia.
Fr. in October and November.

Corchorus antichorus, Raeusch, Nom. ed. 3 (1797) 158.
Vern. N.: Hadeka khet.
Loc.: Jaisalmer: Loharki (No. 5939 !), Sodakoer, in dried-up riverbed (No. 5941 !), Vinjorai, sandy plain (No. 5942 !), Jaisalmer, rocky plateau (No. 5943 !), near Bap (No. 5944 !). Jodhpur: Jodhpur (No. 5937 !), Balarwa (Nos. 5938 !, 5994 !), Barmer, gravel (No. 5926 !), Phalodi, on gravelly soil near town and lake, common (No. 5940 !), one of the commonest plants of the sandy desert tracts.
Distrib.: Cape Verd Islands, Trop. Africa, Arabia, Afghanistan, India.
Fl. and fr. in October and November.
Uses: The leaves are applied to wounds and a decoction of them is said to be efficacious in cases of skin eruption. (Macadam).

Corchorus tridens, L. Mant. App. (1771) 566.
Loc.: Jodhpur: Barmer, sand (No. 5989 !), Jodhpur (Nos. 5917 !, 5919 !), near Badka (No. 5893 !), Osian (No. 5892 !), Bhikamkor, dunes (No. 5930 !), Phalodi (No. 5933 !), Kotda, near Seu (No. 5934 !), Mandor (No. 5936 !). Jaisalmer: Near Loharki (No. 5920 !), Loharki (No. 5927 !), Shihad (No. 5928 !), Amarsagar (No. 5929 !), between Phalodi and Bap (No. 5931 !), Vinjorai (No. 5935 !).
Distrib.: Trop. Africa, India, Australia.
Fl. and fr. in October and November.

Corchorus acutangulus, Lam. Encycl. II (1786), 104.
Loc.: Jodhpur: Jodhpur (No. 5894 !). Jaisalmer: Bada Bag (No. 5915 !).
Distrib.: Trop. Africa, India, Ceylon, Australia, West Indies.
Fr. in October and November.

LINACEÆ.

Linum L.

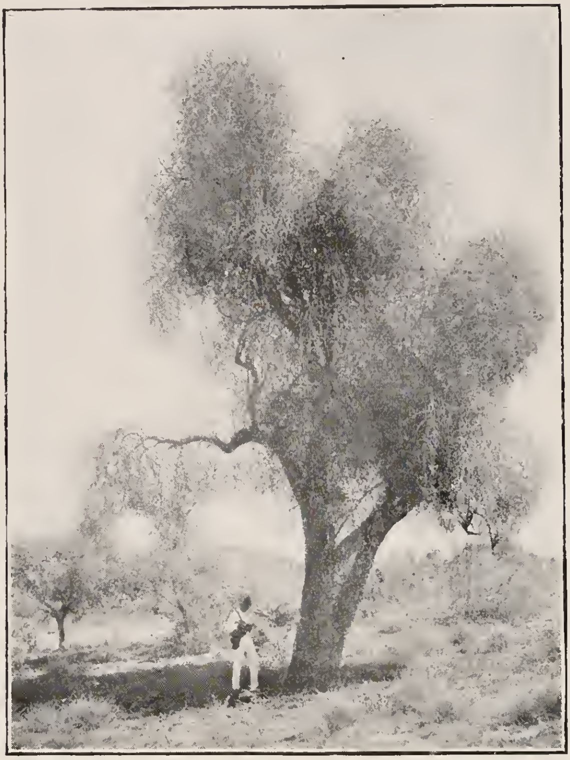
Linum usitatissimum, L. Sp. Pl. (1753) 277.—The Flax plant.
Vern. N.: Alsi.
Cultivated in a few places. (Erskine.)

ZYGOPHYLLACEÆ.

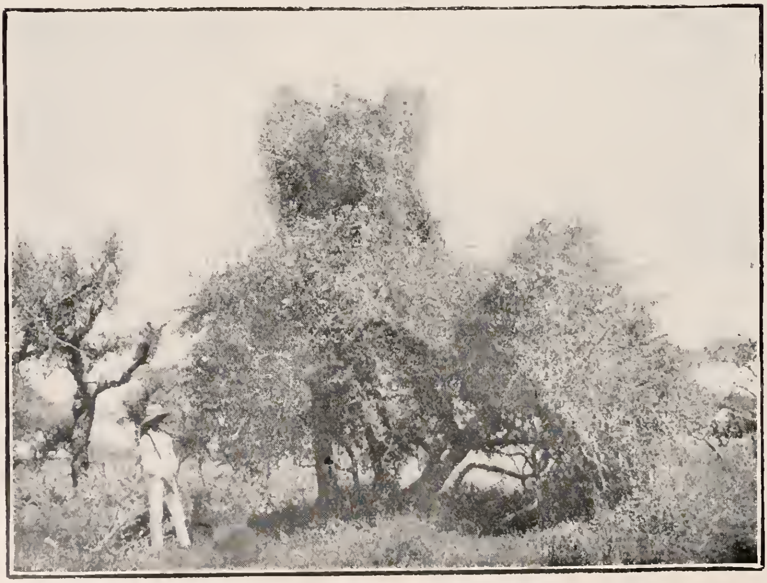
Tribulus Tourn.

Tribulus terrestris, L. Sp. Pl. (1753) 387.
Vern. N.: Gokru, Kanti, Konti (Macadam).
Loc.: Jodhpur: Kailana (No. 7417 !), Mandor (No. 7150 !), Bhikamkor (No. 7157 !), Phalodi (No. 7151 !), Barmer, on rocks and sand (Nos. 7146 !, 7154 !). Jaisalmer: Bada Bag (No 7148 !), Amarsagar (Nos. 7153 !, 7152 !), Devikot (No. 7156 !), Vinjorai, (No. 7149 !), Shihad (No. 7145 !), very common about gardens, road sides, etc. (Macadam).
Distrib.: All warm regions.
Fl. and fr. in October and November; fl. during and after the rains (Macadam).
Uses: Used as a tonic (Macadam).

Tribulus alatus, Del. Fl. Aegypt. Arab. Ill. (1812) 62.
Vern. N.: Bakda (Macadam).
Loc.: Jaisalmer (No. 7132 !), Loharki (No. 7122 !), Devikot (No. 7131 !) Jodhpur: In cultivated places, not very common (Macadam).
Distrib.: Rajputana, Sind to Arabia and N. Africa.
Fl. and fr. in November.



A.—A giant specimen of *Capparis decidua* at Bhikamkor (Jodhpur State).



B.—A characteristic community of plants at Bhikamkor : *Gymnosporia montana*, *Prosopis spicigera*, and rambling on these : *Calligonum poligonoides* and *Cocculus*.

THE FLORA OF THE INDIAN DESERT.

A.—Consocies of *Eclipta erecta* bordering a drying-up pool at Barmer (Jodhpur State).

B.—Families in the consocies of *Eclipta erecta* at Barmer, showing distinct zonation.

THE FLORA OF THE INDIAN DESERT.

Seetzenia Br.

Seetzenia orientalis, Dcne. in Ann. Sc. Nat. ser. 2, III (1835) 281.

Loc.: Jaisalmer: N. of Jaisalmer, gravel (No. 7144!), Jaisalmer, gravel (No. 7159!), Vinjorai, rocks (Nos. 7143!, 7160!), near Devikot (No. 7158!)

Distrib.: Rajputana, Sind, Arabia, N. and S. Africa.

Fl. and fr. in November.

Peganum L.

Peganum harmala, L. Sp. Pl. (1753) 444.

Loc.: Near Palli, plentiful (King).

Distrib.: India to Arabia, N. Africa, Mediterranean.

Zygophyllum L.

Zygophyllum simplex, L. Mantiss. I (1767) 68.

Vern. N.: Lunwa (Macadam).

Loc.: Jodhpur: Phalodi (Nos. 7124!, 7130!), very common in the salt district about Pach Padra. Jaisalmer: Amarsagar (Nos. 7129!, 7128!), Jaisalmer, rocks (No. 7126!), Bap, gravel (No. 7127!), Vinjorai, rocks (No 7125!).

Distrib.: Trop. Africa, W. Asia, Sind, Rajputana.

Fl. and fr. in October and November.

Fagonia L.

Fagonia cretica, L. Sp. Pl. (1753) 386.

Vern. N.: Damasha (Macadam).

Loc: Kailana (Nos. 7142!, 7137!, 7163!, 7165!), Balsamand (No. 7135!), very comon in sandy patches amongst the rocks of Jodhpur (Macadam), Bhikamkor (No. 7168!), Phalodi, sand dunes and gravel (No. 7164!), Barmer (No. 7136!). Jaisalmer: Amarsagar (No. 7167!), Jaisalmer, rocky plateau (No. 7141!), Vinjorai (Nos. 7167!, 7139!), Bap (No. 7138!), near Bap (No. 7161!). Shihad (No. 7140!), Loharki (No. 7162!), near Loharki (No. 7166!), sandy tracts between Balotra and Jaisalmer (Macadam).

Distrib: Both shores of the Mediterranean, in S. extra-trop. Africa, warmer dry parts of Asia, Western N. and S. America.

Fl. and fr. in October and November.

Note: *Fagonia cretica* as taken above includes *F. arabica*, L. and *F. Bruguieri*, DC, which are kept separate by Edgeworth and Hooker in Hook. f. Fl. Brit. Ind. I, 425. *F. cretica* is an extremely variable plant. The form and size of the leaves and stipules are very variable; sometimes the leaves are nearly absent, and their place is supplied by the long and hard spiny stipules; in other cases the leaves are for the most part simple with inconspicuous stipules. There is also great difference in the amount of general pubescence; it varies from nearly perfect smoothness to viscosity.

Uses: The stems form a favourite tooth brush (Macadam).

GERANIACEÆ.

Monsonia L.

Monsonia senegalensis, Guill. and Perr. Fl. Seneg. Tent. I (1830) 131.

Loc.: Jodhpur: Kailana, rocky hills (Nos. 7115!, 7114!, 7113!), Mandor (No. 7116!). Jaisalmer: Bada Bag, on hill (Nos. 7117!, 7118!).

Distrib.: Rajputana, Sind, Baluchistan, Arabia, Senegambia.

Fl. and fr. in October and November.

Monsonia heliotropioides, Boiss. Fl. Or. I (1867), 897.
Loc.: Jaisalmer: North of Jaisalmer, gravel (Nos. 7119 !, 7120 !).
Distrib.: From Rajputana to Egypt.
Fl. and fr. in November.

Erodium L' Herit.

Erodium cicutarium, L' Herit. ex. Ait. Hort. Kew. ed. 1, II (1789) 414.
Loc.: Jaisalmer: North of Jaisalmer (No. 7121 !).
Distrib.: Throughout Europe and temperate N. Asia, Baluchistan, Sind.

Oxalis L.

Oxalis corniculata, L. Sp. Pl. (1753) 435.
Vern. N.: Tipatti.
Loc.: Jodhpur: Common about cultivated places (Macadam).
Distrib.: Cosmopolitan.
Fl. during and after the rains.

RUTACEÆ.

Citrus L.

Citrus aurantium, L. Sp. Pl. (1753) 782.
The Orange. Vern. N.: Narangi.
Loc.: Grown in gardens near Jodhpur and Jaisalmer.

Citrus medica, L. Sp. Pl. (1753) 782, *var. limetta.*
Vern. N.: Mitha nimbu.
The Sweet Lime.
Loc.: Jaisalmer: Bada Bag, cultivated.

SIMARUBACEÆ.

Balanites Del.

Balanites roxburghii, Planch. in Ann. Sc. Nat. ser. 4, II (1854) 258.
Vern. N.: Hingote (Macadam).
Loc.: Jodhpur: Balsamand (No. 7111 !), not uncommon in the plains about Jodhpur, very common in some parts of Godwar, particularly in the neighbourhood of Sadri (Macadam), Osian (No. 7110 !).
Distrib.: Drier parts of India.
Fl. in October.
Uses: The outer rind of the fruit contains a brown greasy pulp with a disagreeable smell. The pulp is used in cough mixtures and to clean silk. The stone emptied and filled with gunpowder is used in fireworks (Macadam).

BURSERACEÆ.

Commiphora Jacq.

Commiphora mukul, Engl. in DC. Monogr. Phan. IV (1883) 12.
Vern. N.: Gugal. The gum is often called Mukul.
Loc.: Jodhpur: Barmer (No. 5818 !), Balsamand (No. 5815 !). Jaisalmer: Bada Bag (No. 5820 !), Jaisalmer (No. 5817 !), Amarsagar (No. 5816 !), Vinjorai, on dunes (No. 5814 !), in rocky dry places about Jaisalmer (Macadam).
Distrib.: Arabia, Baluchistan, Sind, Rajputana.
Fl. and fr. in October and November.
Uses: A gum exudes from the stem in the cold season. It is collected by making incisions with a knife in the tree, and letting the resin fall on the ground. It exudes in large tears, soft and opaque, hardens, and turns brownish black very slowly. A single tree is

said to yield from half to a whole seer. (Stocks). The gum is used medicinally. It also forms one of the ingredients of incense. It is used as a tooth brush and is said to strengthen the gums and to render loose teeth firmer (Macadam).

Commiphora agallocha, Engl. in DC. Monogr. Phan IV, II (=*Balsamodendron roxburghii*, Arn.).
Loc.: Rajputana (Brandis).
Fl. in August and October.

Boswellia Roxb.

Boswellia serrata, Roxb. ex Coleb. As. Res. IX (1807) 379, t. 5.
Vern. N.: Salaran (Macadam).
Loc.: W. Rajputana (Duthie).
Distrib.: Throughout India.
Uses: From wounds and cracks in the bark exudes an abundance of transparent fragrant gum-resin, diffusing, when burnt, an agreeable smell. It is used medicinally and as an incense in India. In the bazaars it is sold under the name of Labanu, Kunaur, or Kundura. (Brandis.) The wood is used for making boxes. (Macadam.)

MELIACEÆ.

Azadirachta A. Juss.

Azadirachta indica, A. Juss. in Mem. Mus. Par. XIX (1830) 221.
Vern. N.: Nim.
Loc.: Planted in villages of Jodhpur and Jaisalmer.
Uses; A decoction of the leaves is used for fever; they are put amongst clothes to keep off moths, etc., and are largely used for camel fodder. The wood is used for building, furniture, etc. The fruit when ripe is sweet and eaten. Its shade is thought specially safe. Its leaves are applied for guinea worm sores. (Macadam).

CELASTRACEÆ.

Gymnosporia W. & A.

Gymnosporia montana, Benth. Fl. Austral. 1 (1863) 400.
Vern. N.: Kangkera (Macadam).
Loc.: Jodhpur: Jodhpur (No. 5792!), Mandor (Nos. 5795!, 5797!), Bhikamkor (No. 5794!), Osian (No. 5790!), Barmer, sand (No. 5798!), Barmer, on rocks (No. 5791!). Jaisalmer: N. of Jaisalmer (No. 5796!), Amarsagar (No. 5793). In rocky places about Jaisalmer (Macadam).
Distrib.: Central Africa, Afghanistan, Pers. Baluchistan, India, Malaya, Australia.
Fl. in October.
NOTE: All the above specimens, with the exception of Nos. 5792 and 5797 from Jodhpur and Mandor have got narrow leaves. The broad-leaved form seems to have its western limit in Eastern Jodhpur.
Uses: Rosary beads are made from the wood, and the leaves burnt and mixed with ghee, form an ointment used to heal sores. (Macadam).

RHAMNACEÆ.

Zizyphus Tourn.

Zizyphus jujuba, Lam. Encycl. III (1789) 318.
Vern. N.: Ber, Bor (Macadam).
Loc.: Jodhpur: Bhikamkor (No. 5786!). Generally near villages, cultivated and self-sown, also in Jaisalmer State. (Macadam.)

Distrib. : Africa, Afghanistan, Ceylon, India, China, Australia.
Fl. in October.
Fr. in the cold weather (Macadam).
Uses : The fruit is eaten. The wood is used for building purposes railway sleepers, furniture, lacquered toys (Macadam).

Zizyphus trinervia, Roxb. Hort. Beng. (1814) 17 (*non* Poir).
Loc. : Jaisalmer : Amarsagar (No. 5804 !).
Distrib. : India.
Fr. in November.

Zizyphus rotundifolia, Lam. Encycl. III (1789), 319.
Vern. N.: Ber, Bor, Bordi.
Loc. : Jodhpur : Osian (Nos. 5805 !, 5801 !), Phalodi (No. 5806 !), Mandor (No. 5807 !), Jodhpur (No. 5808 !), Balsamand (No. 5799 !). Jaisalmer : Shihad (No. 5709!), Vinjorai, sandy plain (No. 5810 !), Devikot (No. 5811 !), near Loharki (No. 5812 !), Loharki (No. 5802 !), very common in dry sandy places, associated with *Aerua tomentosa* and *Leptadenia spartium* (Macadam).
Distrib. : Persia, India.
Fr. early in the cold weather (Macadam).
Uses : The fruit is eaten. The leaves are used as fodder, called pala (Macadam).

Zizyphus truncata, spec. nov.—Frutex ramis divaricatis, castaneis, junioribus puberulis. Aculei gemini, glabri, basi aliquantulum tomentosi, 10 mm attingentes, unus paullo brevior altero recto et retrocurvatus. Folia subdistiche alterna, petiolata, coriacea, orbiculata vel aliquantulum longiora quam lata, 35 mm. attingentia, serrulata, basi subcordata, apice truncata (parte truncata usque ad 10 mm. longa et irregulariter dentata), glabra, excepta pubescentia in petiolo, margine necnon nervis nervulisque in facie inferiore ; nervi basales tres, prominentes, currentes ad apicem, costa media cum duobus aut tribus paribus nervorum secundariorum, ceteri duo nervi nervis lateralibus muniti in parte exteriore. Petiolus usque ad 5 mm. longus.
Cymæ breves, axillares, sessiles, tomentosæ ; gemmæ hemisphericæ, tomentosæ ; pedicelli subnulli vel usque ad 4 mm. longi. Calyx 5-fidus, lobis late triangularibus acutis patentibus, intus carinatis in parte superiore. Petala spathulata, apice rotundata. Discus 10 lobatus, profunde 10-sulcatus. Styli 2, connati, parte superiore divergentes.
Fructum non vidimus.
Affinis est hæc species *Zizypho rotundifoliæ*, sed differt foliis (quoad formam, magnitudinem, nervaturam, glabreitatem), aculeis, disco.
Loc. : Jodhpur : Kailana (No. 5803 !).
Fl. in October.

Zizyphus xylopyra, Willd. Sp. Pl. I (1797) 1104.
Vern. N.: Gatbor (Macadam).
Loc. : Jodhpur : Mandor (No. 5813 !).
Distrib. : India.
Fl. in October.
Uses : The wood is used for fuel.

VITACEÆ.

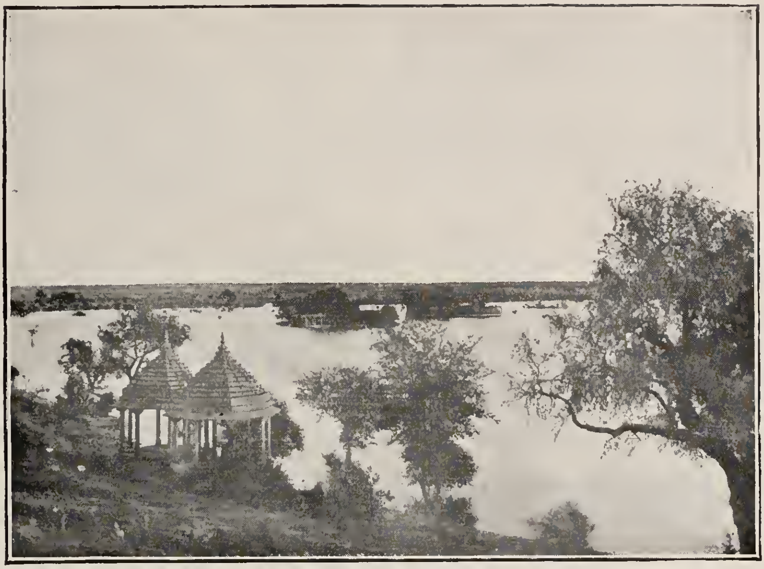
Vitis L.

Vitis vinifera, L. The Vine.
Found cultivated in the Bada Bag Garden near Jaisalmer (No. 6737!).

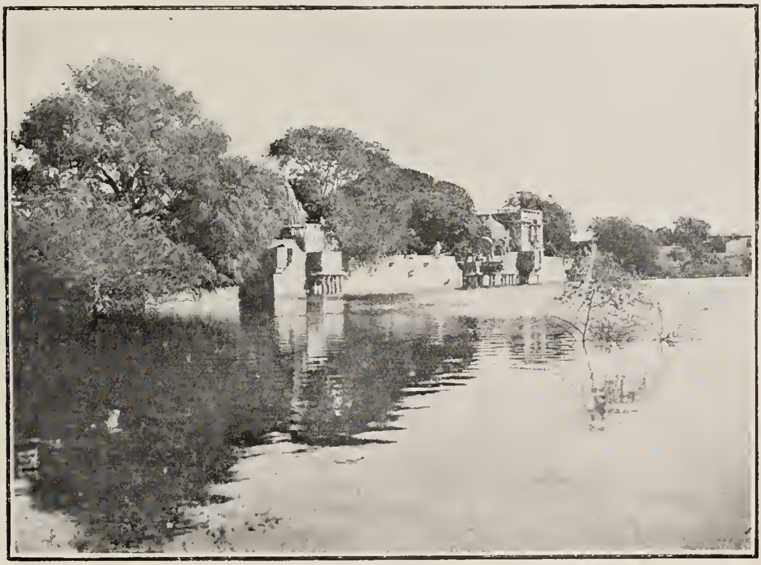
A.—The Bada Bag in the neighbourhood of Jaisalmer Town.

B.—The tank belonging to the above Garden shaded by *Acacia arabica*.

THE FLORA OF THE INDIAN DESERT.



A.—Gharsisar Lake outside Jaisalmer Town. The water level is abnormally high on account of the heavy rains of 1917. In the foreground: *Capparis decidua, Prosopis spicigera, Salvadora oleoides, Zizyphus.*



B.—Amarsagar Lake near Jaisalmer Town, irrigating the garden of the same name. Chief trees: *Azadirachta indica, Zizyphus jujuba, Acacia arabica, Prosopis spicigera, Albizzia.*

THE FLORA OF THE INDIAN DESERT.

SAPINDACEÆ.

Cardiospermum L.

Cardiospermum halicacabum, L. Sp. Pl. (1753) 366.
Loc. : Jodhpur : Kailana (No. 6749 !), near Badka (No. 6745 !), Kotda near Seu (No. 2454 !), Barmer, rocks (No. 6746 !).
Distrib : Most warm countries.
Fl. and fr. in October and November.

ANACARDIACEÆ.

Mangifera L.

Mangifera indica, L. Sp. Pl. (1753) 200.
Loc : Jodhpur : Osian. Jaisalmer : Amarsagar (No. 6779 !).

Rhus, L.

Rhus mysorensis, Heyne ex Wight and Arn. Prodr. (1834) 172.
Loc. : W. Rajputana (Duthie).
Distrib. : India.

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MORINGACEÆ.

Moringa Lam.

Moringa pterygosperma, Gærtn. Fruct. II (1791) 314.
Loc. : Jaisalmer : Amarsagar (No. 6117 !).
Distrib. : Forests of the Western Himalaya and Oudh, cultivated elsewhere in India and in various tropical countries.

Moringa concanensis, Nimmo in Grah. Cat. Bomb. Pl. 43.
Vern. N. : Sirgura (Macadam). Horse-radish tree.
Loc. : Jodhpur : Barmer, on rocks (Nos. 5883 !, 5873 !).
Distrib. : Concan, Rajputana, Sind.

LEGUMINOSÆ.

I. Papilionaceæ.

Heylandia DC.

Heylandia latebrosa, DC. Mem. Leg. 201.
Vern. N. : Gorakbulti, Sonda (Macadam).
Loc. : Jodhpur : Jodhpur (No .7168 !), Balarwa (No. 7169), Jaisalmer : Jaisalmer, rocky plateau (No. 7174), Jaisalmer, gravel (No. 71731) between Phalodi and Bap (No. 7170 !), Shihad (No. 7171 !), Vinjorai (No. 7176 !), Devikot (No. 7175 !), frequent in sandy places. Macadam).
Distrib. : India, Ceylon.
Fl and fr. in Oct. and Nov

Crotalaria L.

Crotalaria burhia, Hamilt. in Wall. Cat. (1828) 5386.
Vern. N. : Sannia (Macadam).
Loc. : Jodhpur : Kailana (No. 6935 !, 6936 !), Balsamand (No. 6926 !), Osian (No. 6933 !), Bhikamkor (No. 6934 !), Barmer (No. 6931 !). Jaisalmer : near Bap (No. 6929 !), Sodakoer (No. 6927 !), Sodakoer, riverbed (No. 6928 !), Devikot (No. 6930 !), Vinjorai (No. 6932 !), common in sandy places in the plains (Macadam).
Distrib. : N. W. India, Gujarat, Sind, Baluchistan, Afghanistan.
Fl. and fr. in Oct. and Nov.

Crotalaria medicaginea Lam. Encycl. Meth. II (1786) 201.

Loc.: Kailana (No. 6940 !), Balsamand (No. 6939 !), Balarwa (No. 6941 !). Jaisalmer: between Phalodi and Bap (No. 6938 !), Bada Bag (No. 7220 !).
Distrib.: Afghanistan, Indo-Malaya, Australia.
Fl. and fr. in Oct. and Nov.

Crotalaria retusa L. Spec. Pl. (1753) 715.
Loc.: Jodhpur: Balsamand (No. 6937 !).
Distrib: Tropics of the Old World.
Fl. and fr. in Oct.

Cyamopsis DC.

Cyamopsis psoralioides DC. Prodr. II (1825) 216.
Vern. N.: Guar.
Loc.: Jodhpur: Jodhpur (No. 7018 !), Balarwa (No. 6712 !), Osian (No. 7008 !), Phalodi (No. 7017 !), near Badka (No. 7011 !). Jaisalmer: Amarsagar (No. 7016 !), Jaisalmer, sand (No. 7009 !, 7014 !), Shihad (No. 7015 !), near Devikot (No. 7013 !), Vinjorai (No. 7010 !).
Distrib.: Afghanistan, cultivated in India.
Fl. and fr. in Oct. and Nov.
Uses: Grown as a vegetable. The whole plant is a good fodder for cattle.

Medicago L.

Medicago laciniata All. Fl. Pedem. I (1785) 316.
Loc.: North of Jaisalmer (No. 7221 !).
Distrib.: Punjab, Salt Range, Rajputana, Sind, Baluchistan, Egypt, Abyssinia.

Indigofera L.

Indigofera linifolia Retz. Obs. Bot. fasc. 4 (1786) 29 et fasc. 6 (1791) t. 2
Vern. N.: Bekar (Macadam).
Loc.: Jodhpur: Jodhpur (No. 7041 !, 7040 !), Mandor (No. 7042 !), Osian (No. 7039 !), Balarwa (No. 7037 !, 7045 !), Bhikamkor (No. 7038 !), near Badka, sand (No. 7044 !). Jaisalmer: Vinjorai (No. 7043 !), common about cultivated places (Macadam).
Distrib.: Abyssinia, Afghanistan, India, Ceylon, N. Australia.
Fl. and fr. in Oct. and Nov.
Uses: The seeds are ground and eaten by the very poor in times of famine (Macadam).

Indigofera cordifolia Heyne ex Roth Nov. Pl. Sp. (1821) 357.
Loc.: Jodhpur: Jodhpur (No. 7201 !), Kailana (No. 7181 !), Mandor (No. 7180 !), Osian (No. 7195 !, 7193 !), Bhikamkor (No. 7190 !), Phalodi (No. 7183 !), Barmer, rocks (No. 7179 !), Barmer (No. 7178 !, 7189 !), near Badka (No. 7185 !, 7188 !), Kotda near Seu, gravel (No. 7198 !). One of the commonest plants. Jaisalmer: Jaisalmer (No. 7177 !, 7186 !), Jaisalmer, rocky plateau (No. 7187 !, 7196 !), Bada Bag (No. 7192 !), Amarsagar (No. 7199 !), Devikot (No. 7191 !), Vinjorai, dunes (No. 7184 !, 7200 !), Vinjorai, gravel (No. 7182 !), near Bap (No. 7194 !), Shihad (No. 7197 !).
Distrib.: India, Afghanistan, Baluchistan, N. Australia.
Fl. and fr. in Oct. and Nov.

Indigofera trigonelloides Jaub. & Spach I 11. V (1857) 92, 482.
Loc.: Jodhpur: Jodhpur (No. 7079 !), Kailana (No. 7075 !), Bhikamkor (No. 7074 !), Phalodi (No. 7076 !). Jaisalmer: Loharki (No. 7078 !), Jaisalmer, gravel (No. 7077 !).
Distrib: Punjab, Rajputana, Sind, Afghanistan, Arabia, Abyssinia.

Fl. and fr. in Oct. and Nov.

Note: Seeds often more numerous than mentioned by Cooke and Hooker f., up to 6 in a pod.

Indigofera enneaphylla L. Mantiss. II (1771) 571.

Loc.: Jodhpur: Mandor (No. 7080 !), Balarwa (No. 7081 !).

Distrib: Indo-Malaya, N. Australia.

Fl. and fr. in Oct.

Indigofera paucifolia Del. Fl. d'Egypte (1812) 251.

Vern. N.: Goila, Jhil.

Loc.: Jodhpur: Jodhpur (No. 7070 !, 7069 !), Kailana (No. 7062 !), Mandor (No. 7064 !), Balsamand (No. 7066 !), very abundant in Godwar (Macadam), in the plains about Jodhpur, but not very common. Jaisalmer: Bada Bag (No. 7067 !), Jaisalmer, sand (No. 7063 !).

Distrib.: Trop. Africa, Arabia, Baluchistan, Indo-Malaya.

Fl. and fr. in Oct. and Nov.

Note: The leaves are very often 1 foliolate.

Uses: Eaten by animals, used for tooth brushes.

Indigofera argentea Burm. Fl. Ind. (1768) 171. (*Non* L.).

Vern. N.: Nil.

Loc.: Jodhpur: Osian (No. 7028 !, 7030 !), Phalodi (No. 7026 !), near Badka (No. 7025 !) Barmer, sand (No. 7027 !, 7033 !). Jaisalmer: Loharki (No. 7024 !), Loharki, sand dunes (No. 7034 !), near Loharki, sand, especially dunes (No. 7029 !), Devikot, sand (No. 7222 !), Vinjorai (No. 7032 !).

Distrib.: Abyssinia, Egypt, Arabia, Sind, Rajputana.

Fl. and fr. in Oct. and Nov.

In specimen No. 7222 the pods generally contain 1-2 seeds and the pod itself is torulose; but as there is a pod of the ordinary *argentea* type on the same plant our specimen must be considered as a form of that species. The racemes are unusually short, 1-4 flowered, the rhachis is stout, about as long as the leaf, which is much smaller than usual and 3-5 foliolate.

Uses: Used for dyeing (Macadam).

Indigofera houer Forsk. Fl. Aeg.-Arab. (1775) 137.

Loc.: Jodhpur (No. 7073 !).

Distrib.: India, Arabia, Egypt, Abyssinia.

Fr. in Oct.

Indigofera tinctoria L. Sp. Pl. (1753) 751.

Loc.: Jodhpur: Jodhpur Fort (No. 7071 !), 25 miles S. E. of Luni (No. 7072 !).

Fl. and fr. in Oct. and Nov.

Indigofera anabaptista Steud. Nom. ed. 2 (1840) 805.

Loc.: Jodhpur: Jodhpur (No. 7054 !), Mandor (No. 7051 !), Bhikamkor (No. 7046 !, 7056 !), Phalodi (No 7055 !), Kotda near Seu, gravel (No. 7053 !), near Badka (No. 7059 !). Jaisalmer: between Phalodi and Bap (No. 7050 !), Shihad (No. 7058 !, 7057 !), Bada Bag near Jaisalmer (No. 7060 !), Amarsagar (No. 7049 !), Vinjorai, rocks (No. 7052 !).

Distrib.: Rajputana, Punjab, Sind, Afghanistan, Arabia.—Cooke calls it a very rare plant in India. It is certainly very common in Jodhpur and Jaisalmer.

Psoralea L.

Psoralea odorata spec. nov.

Herba perennis ramosissima odoratissima quando sicca (sicut Anthoxanthum odoratum), circa 60 cm. alta et amplius, ramis ascendentibus formantibus angulum acutum cum caule. Caulis ramique teretes, striati, adpresse hirsuti, verucosi. Folia pinnatim 3-foliolata. Petiolus 2 cm. attingens, argento-cancescens, parce verucosus. Stipulæ triangulares acutæ, basi lata, aliquantulum falcatæ, circa 3 mm longæ, argento-canescentes, fortiter nervatæ, par stipularum decurrens et formans tres lineas elevatas in internodio, lineis lateralibus repente curvatis. Folioli oblanceolati, apice rotundi vel subacuti vel apiculati, nervis superne profunde depressis, prominentibus inferne, valde adpresse hirsuti, speciatim inferne; foliolus terminalis maximus, 22 mm. longus, 6 mm. latus, laterales vero 12 mm. longi et 5 mm. lati, omnes glandulo punctatis inferne, interdum parce superne, margine irregulariter sinuati, basi acuti. Petioluli circa ½ mm. longi.

Flores fasciculati, rarius solitarii in spicas axillares 10 cm. longas conferti. Rhachis verucosa. Pedicelli 1 mm. attingentes. valde hirsuti. Bractæ minutæ, ovato-acutae, parce hirsutæ. Calyx 3 mm. longus, dense argento-hirsutus externe, lobi triangulares, ovati, acuti, breviores tubo, infimus maximus, sed superiores attingentes altius. Corolla aliquantulum exserta, vexillum late obovatum, emarginatum, margine sinuatum, album, alæ oblique oblongæ, lobo magno rotundo munitæ circa medium marginis posterioris, albae, apice caerulescentes cohærentes cum petalis carinæ. Petala carinae cohærentia, aliquantulum lobata in parte posteriore, alba, apice caerulescentia. Stamen vexillare basi connatum cum caeteris. Ovarium stipitatum, glabratum. Stylus filiformis, compressus, incurvus: stigma parvum.

Legumen (immaturum) dense hirsutum, stylo persistente munitum. Semina (immatura) compressa, reniformia, brunnea.

Loc.: Jodhpur : Barmer, sand (No. 7005 !), near Kotda (No. 7003 !), Jaisalmer: Devikot (No. 7004 !), near Bap (No. 7002 !).

Fl. and fr. in Nov.

NOTE: This species differs from *P. plicata* Del. by the colour of the corolla, by the longer petioles, hairiness of the stem and branches, and the shape of the stipules.

Tephrosia Pers.

Tephrosia tenuis Wall. Cat. (1828) 5970.

Loc.: Jodhpur: Jodhpur (No. 6961 !), Osian (No. 6962 !), Balarwa (No. 6963 !), Kotda near Seu, rocks (No. 6964 !).

Distrib.: India, Laccadives.

Fl. in Oct., fr. in Oct. and Nov.

Tephrosia purpurea Pers. Syn. Pl. II (1807) 329.

Loc.: Jodhpur: Jodhpur (No. 6983 !, 6978 !), Bhikamkor (No. 6979 !), Osian (No. 6980 !), Phalodi (No. 6981 !). Jaisalmer: Vinjerai (No. 6982 !).

Distrib.: Tropics generally.

Fl. and fr. in Oct. and Nov.

Tephrosia incana Grah. in Wall. Cat. 5644; Wight. and Arn. Prodr. 212; Wight Ic. 371; Grah. Cat. 47.—*Galega incana* Roxb. Fl. Ind. III, 385.—*Tephrosia Ehrenbergiana* Schweinf. Pl. Athiop. 18.—*T. villosa* Pers. *var. incana* Bak. in Hook. f. Fl. Brit Ind. II, 113; Cooke, Fl. Bomb. Pres. I (1903) 323.

var. horizontalis var. nov. Differt a typo sequentibus: Folioli 7-9, obovati, cuneati, minus lati, profunde emarginati, mucronulati. Stipulæ subulatæ, longiores. Flores generatim 4-fasciculati in rhachide gracillima angulosa flexuosa terminali vel laterali usque 10 cm. longa. Fasciculus infimus generatim in axilla folii subtendentis. Pedicellus floris usque ad 4 mm, fructus ad 5 mm attingens. Legumen horizontale, 4 cm. attingens, delicatule albo-pubescens, stylo integro glabro munitum.

Loc.: Jodhpur: Jodhpur (No. 6977!). Jaisalmer: Vinjorai, sandy plain (No. 6976).

Distrib. of type: Trop. Africa, Mauritius, India.

Fl. and fr. in Oct. and Nov.

NOTE: *Tephrosia incana* Grah. has been made a variety of *T. villosa* Pers. by Baker. Roxburgh's description of the plant and Wight's illustration make it difficult to understand how those two species should ever have been united.

Tephrosia multiflora spec. nov.

Herba perennis, ramosa a basi; rami erecti vel ascendentes, 50 cm. attingentes, graciles, dense piloso-pubescentes. Folia imparipinnata, 8 cm. attingentia, generatim, 7-, rarius 5-foliolata. Stipulæ reflexæ, subulatæ, 3-nervatæ. 6 mm. attingentes. Petiolus 3 cm. longus; rhachis sulcata, hirsuta; petiolulus usque ad 1 mm. attingens. dense hirsutus. Folioli elliptici oblongi, terminalis 3 mm. longus, 9 mm. latus, laterales minores, apice obtusi. retusi vel minutim apiculati, basi rotundati vel cuneati, facie ventrali glabri, dorsali argento-canescentes.

Flores fasciulati, axillares, 1-6 formantes fasciculum. Pedicelli 2 3 mm. longi. Calyx 2½ mm. longus, dense hirsutus: lobi setacei. tubo plus minusve æquilongi. Corolla exserta. rubra; vexillum hirsutum in dorso, ceteræ corollæ partes glabræ. Ovarium hirsutum; stylus compressus, glaber. Legumen lineare. aliquantulum turgidum, 3 cm. longum, valde curvatum, cuspide brevi triangular munitum, dense pilosum, intus continuum. Semina 6-8. pallida.

Near Roxburgh's *T. pentaphylla* which Baker in Hook. f. Fl. Brit. Ind. II. 112. puts under *T. senticosa* Pers. *T. pentaphylla* Roxb. Fl. Ind. III, 384, should be retained as a distinct species. *T. senticosa* has a glabrous pod according to DC. Prodr. II, 254. Baker says it is persistently thinly canescent, while the pod of Roxburgh's plant is villous. Cooke's *T. senticosa* (in Fl. Bomb. Pres. I, 326) as far as is apparent from his description, seems to be *T. pentaphylla* Roxb.

Loc.: Jodhpur: Kotda near Seu (No. 6975!), Jaisalmer: Shihad (No. 6974!).

Tephrosia petrosa spec. nov. (=*T. spinosa* Baker in Fl. Brit. Ind. II, 112 *partim, non* Pers.).

Suffrutex vel frutex humilis, profuse ramosus a basi et altius, rami terminales gracillimi, argento-canescentes, angulosi. Folia 4½ cm. longa. Stipulæ 5-6 mm. longæ. subulatæ, costa media conspicua, argento-canescentes, generatim reflexæ, rigidæ, sed non magis quam in aliis generis hujus speciebus: rhachis hirsuta. petioluli vix. 1 mm. attingentes, hirsuti. Folioli generatim 5, interdum 3 vel 7, nunquam 9, terminalis generatim maximus, 27 mm longus, 9 mm. latus omnes obovati, apice rotundati, mucronati mucrone 1 mm. longo, facie superiore glaberrima. facie vero inferiore, margine et mucrone dense argento-canescentibus.

Flores axillares solitarii, raro gemini ; pedicelli florum circa 2½ mm., fructus vero 5 mm. longi. Calyx 3 mm. longus, non ampliatus in fructu ; lobi subulati, tubo aequilongi ; pedicellus et calyx hirsutissimi. Corolla larga, valde exserta, conspicua, rubra purpurascens. Vexillum hirsutum in dorso. Stamina diadelpha. Ovarium dense hirsutum. Stylus glaber. Stigma largum, penicillatum.

Legumen 3-5 cm. longum, lineare, attenuatum basim versus, valde curvatum, cuspidatum, argento-canescens. Semina numerantia usque ad 8, duplo latiora quam longa, subcylindrica, aliquantulum compressa, colore olivæ, variegatæ.

Loc. : Jodhpur : Balsamand (No. 6966 !), Jodhpur (No. 6965 !), Kotda near Seu (No. 6972 !), Barmer, rocks No. 6973 !). Jaisalmer : Vinjorai (No. 6971 !), Jaisalmer, rocky plateau (No. 6970 !), N. of Jaisalmer (No. 6969 !), Bada Bag (No. 6968 !).

Fl. and fr. in Oct. and Nov.

Vern. N. : Bishoni.

Uses : The leaves boiled in water and eaten are considered to be good against syphilis.

Note : Baker in Hook. f. Brit. Ind. II, 112 has evidently united specimens identical with or at least very similar to ours with *T. spinosa* Pers. We consider Roxburgh's description of *T. spinosa* (under *Galega spinosa* Willd. in Fl. Ind. III, 383) to be the correct one. In the same way we include Wight's description and plate (Ic. 372) under *T. spinosa*, as he says himself that he has copied them from Roxburgh's drawing. Baker's description differs in several points from Roxburgh's and can therefore not be considered as that of *T. spinosa* Pers. Baker's material comes from the Western Peninsula, whilst Roxburgh's plant is a native "of dry barren land on the coast of Coromandel." We may add that we have never found *T. spinosa* in the Western Peninsula.

Sesbania Scop.

Sesbania aculeata Poir. Encycl. VII (1806) 128.

Loc. : Jodhpur : Jodhpur (No. 7023 !), Balarwa (No. 7019 !). Jaisalmer : Amarsagar (No. 7024 !), Vinjorai (No. 7022 !), Devikot (No. 7021 !), between Phalodi and Bap (No. 7020 !).

Distrib. : Tropics of the Old World.

Fl. in Oct., fr. in Oct. and Nov.

Alysicarpus Neck.

Alysicarpus monilifer DC. var. *venosa*, var. nov.—Legumen conspicue reticulato-venosum, saepe uno semine.

Loc. : Jaisalmer : Bada Bag (No. 7225 !, 7226 !).

Distrib. of type : India, Nubia, Abyssinia.

Fl. and fr. in Nov.

Alysicarpus hamosus Edgew. in Jour. As. Soc. Beng. XXI (1853) 171.

Loc. : Jaisalmer : Bap (No. 7227 !).

Distrib. : India.

Fl. and fr. in Oct. and Nov.

Alysicarpus vaginalis DC Prodr. II (1825) 353.

Loc. : Jodhpur : Balsamand (No. 7228 !). Jaisalmer : Jaisalmer, sand (No. 7229 !, 7230, 7231 !).

Distrib. : Tropics of the Old World.

Fl. in Oct., fr. in Oct. and Nov.

Alysicarpus rugosus DC. Prodr. II (1825) 353.

Loc. : Jodhpur : 25 miles S E. of Luni (No. 7232 !). Jaisalmer : between Phalodi and Bap in field (No. 7233 !).

Distrib. : Tropics of the Old World, Cape, West Indies.
Fr. in Oct. and Nov.

Alysicarpus rugosus var. styracifolius Baker in Hook. f. Fl. Brit. India II 159.
Loc. : Jodhpur: Balsamand (No. 7234 !).
Distrib. : India.
Fr. in Oct.

Alysicarpus tetragonolobus Edgew. in Jour. As. Soc. Beng. XXI (1853) 169.
Loc.: Jodhpur : Erinpura Road (No. 7235 !)
Distrib. : India.
Fl. and fr. in Oct.

Butea Roxb.

Butea frondosa Konig ex Roxb. As. Res. III (1792) 469.
Loc. : Jodhpur State (Adams).
Distrib. : India, Ceylon.

Alhagi Tourn.

Alhagi camelorum Fisch. Ind. Hort. Gorenk. ed. 2 (1812) 72.
Vern. N.: Jawasa (Macadam).
Loc. : Jodhpur and Jaisalmer States (Macadam).
Distrib. : India, Baluchistan, Arabia, Egypt.
Uses: Valued as fodder, as the leaves come out in the hot weather when there are few green things to be had. Much used for tatties (Macadam).

Canavalia Adams.

Canavalia ensiformis DC. Prodr. II (1825) 404.
Loc.: Jaisalmer: Amarsagar (No. 7001 !), probably cultivated.
Fl. in Oct. and Nov.
Note: Our specimen is a slender form with few-flowered racemes.

Phaseolus L.

Phaseolus trilobus Ait. Hort. Kew III, 30.
Vern. N.: Jungli math.
Loc: Jodhpur: Bhikamkor (No. 6984 !), near Badka (No. 6988 !), Kotda (No. 6990 !), Barmer (No. 6992 !). Jaisalmer: Bada Bag (No. 6986 !), Vinjorai (No. 6987 !), Vinjorai, sandy plain (No. 6989 !), Jaisalmer (No. 6991 !).
Distrib.: Trop. Africa, Indo-Malaya, Afghanistan.
Fl. and fr. in Oct. and Nov.
Uses: Eaten by cattle.

Phaseolus aconitifolius Jacq. in Obs. Bot. III (1768) 2, t. 52.
Vern. N.: Moth.
Loc. : Jodhpur: Jodhpur (No. 6997 !), Mandor, (No. 6998 !), Osian (No. 6996 !), cultivated throughout Jodhpur and Jaisalmer. This species and *Phaseolus mungo* are grown on light soil, sometimes alone but usually with bajra (*Pennisetum typhoideum*) or jowar (*Sorghum vulgare*).
Distrib.: Native of India, generally cultivated.

Phaseolus radiatus L Sp. Pl. (1753) 725.
Loc.: Jodhpur: Mandor (No. 6994 !), Osian (No. 6993 !). Jaisalmer: between Phalodi and Bap (No. 6995 !).
Fl. and fr. in Oct.

Phaseolus mungo L. *var. Roxburghii* Prain in Journ. As. Soc. Beng. LXVI (1898) 423.
Vern. N. : Mung.
Loc.: Cultivated in Jodhpur State (Erskine) and Jaisalmer.

Vigna Savi.

Vigna sp.
Loc. : Jodhpur : Osian (No. 7000 !).

Dolichos L.

Dolichos biflorus L. Spec. Pl. (1753) 727. Horse gram.
Vern. N. : Khulat.
Loc. : Cultivated in Jodhpur State (Erskine).
Distrib. : Tropics of the Old World.

Cicer L.

Cicer arietinum L. Gram, Chickpea.
Loc. : Jodhpur : termination of Luni river when dry ; in the following parganas : Parbatsar, Bali, Sojat (Adams).
Native country uncertain, widely cultivated throughout India.

NOTE : Gram is a " cold weather crop, grown usually alone, but sometimes mixed with barley ; it is found mostly in Bilara, Merta, Sojat and Pali, and requires a light loamy soil, but is neither irrigated nor weeded. The land is ploughed four times before the seed is sown in October, and is then harrowed once ; if rain falls in December and January, a fine crop is almost a certainty, but there is always danger of damage by frost, and lightning is supposed to be injurious if the pulse be in blossom. When the seedlings begin to branch and before flowers are produced, the leading shoots are sometimes nipped off to make the plants bushier and more productive, and the cuttings are used as a vegetable called pansi. Gram ripens from February to April, is reaped with a blunt sickle, and is generally uprooted ; the out-turn averages only 3½ cwt. of pulse per acre, the grain being split and used as dal and the fine chaff making an excellent fodder" (Erskine).

Rhynchosia Lour.

Rhynchosia minima DC var. *laxiflora* Baker in Hook. f. Fl. Brit. Ind. II, 223.
Loc. : Jodhpur : Mandor (No. 6953 !), Kailana (No. 6959 !, 6958 !, 6957 !, 6951), Barmer, rocks (No. 6950 !), Kotda near Seu (No. 6951 !), 25 miles N.E. of Luni (No. 6954 !). Jaisalmer : Amarsagar (No. 6956 !, 6955 !), Vinjorai rocks (No. 6952 !).
Distrib. of type : Tropics generally. Of variety : Deccan, S. M. Country, Rajputana, Sind.
Fl. and fr. in Oct. and Nov.

NOTE : The plants do not agree with Cooke's statement that *R. minima* has black seeds ; the ground colour is a pale olive green, mottled with grey and black to a varied extent. The pod is very often only 1 seeded, when it is about 8 mm. long and 5 mm. broad. The 2-seeded pods are 20 by 5 mm.

Rhynchosia rhombifolia spec. nov.
Herba gracilis volubilis, circa 75 cm. longa, minutim cinerascens-pubescens. Caulis subteres. Folia membranacea, pinnatim 3-foliolata, 7 cm. attingentia, petiolo angulari, 4 cm. longo, petiolulis 1 mm. excedentibus. Foliolus terminalis rhomboideus, latior quam longus, 30 mm. longus, 37 mm. latus, angulo apicali circa 120 gradus mensurante, angulo basali largiore, apice rotundus, basi rotundus vel inter-

dum aliquantulum subcordatus, angulis lateralibus obtusis. Folioli laterales multo minores, valde variabiles quoad magnitudinem, suborbiculati, valde obliqui, margine superiore semicirculari, inferiore magis rhomboideo, nervis inferne prominentibus, conspicuis, albis, omnibus foliolis minutim apiculatis, pallide virescentibus, maturis in utraque facie pubescentibus.

Flores in racemis axillaribus. Racemi circiter eadem longitudine ac foliorum, paucos habentes flores, laxi, pedicellis 2 mm. longis, curvatis. Calyx dense hirsutus; lobi 5, duo superiores breviores, infimus duplo longior et tubo longior. Petala unguiculata, dimidio longior calyce, vexillum hirsutum in dorso, pallide flavum, alæ minus flavæ; stamina diadelpha; stylus gracilis, curvatus, dense hirsutus. Ovula 2.

Legumen falcatum, attenuatum basim versus, 18 mm. longum, 5 mm. latum, seminibus 2, vel 10 mm. longum, 6 mm. latum, semicirculare, semine unico, compressum, cuspide munitum 1½ mm. longo, valvis minutim tomentoso-pubescentibus. Semina flava, cicatrice nigra 1 mm. longa prope hilum. Hilum obtectum membrana quæ est extensio funiculi seminis, minime vero strophiolus.

Note: The same tiny hardened drops have been observed on the lower surface of the leaves and on the pod which we have noted under *R. arenaria*, with the difference however that they are colourless instead of yellow.

Loc.: Jaisalmer: Amarsagar (No. 6849 !, 6948 !), Jaisalmer, rocky plateau (No. 6947 !).

Fl. and fr. in Nov.

Rhynchosia arenaria spec. nov. (Pertinet ad Eurhynchosias.)

Frutex humilis, prostratus vel suberectus, ramis dense foliosis usque ad 60 cm. attingentibus, primariis procumbentibus, secundariis erectis circa 30 cm. longis; tota planta dense cinereo-tomentoso-pubescens. Folia conferta, pinnatim trifoliata, 3 cm. longa, foliolo terminali late obcordato, basi cuneato, 15 mm. longo et lato, laterali vero minore, obliquo suborbiculato, omnibus denique mucronatis, integerrimis, pallidioribus inferne quam superne, margine reflexo, nervis tribus subbasalibus. Petiolus 15 mm. attingens, interdum fere absens, petiolulus 1 mm. attingens.

Flores pauci, flavi, in racemis axillaribus gemini, raro solitarii, pedunculo 4 mm. longo, pedicellis 3 mm. longis. Calycis lobi tubo paullo longiores, subæqualibus, subulatis. Petala unguiculata, paullo exserta, vexillum suborbiculatum, 6 mm. longum, aliquantulum emarginatum, in dorso dense hispidum; stamina diadelpha; ovarium dense pubescens, 2-ovulatum.

Legumen 25 mm. longum, 9 mm. latum, compressum, margine incrassato, falcatum, attenuatum versus basim, dense persistenter tomentosum, cuspide 1½ mm. longo. Semina 2, (vel 1 in leguminibus brevioribus) orbiculata, paullo compressa, brunnea, flavescentia circa hilum, glabra, seminum funiculo in membranam tenuem hilum obtegentem expanso, sed non vere strophiolato.

Note: Embedded in the tomentum of the under surface of the leaves there are innumerable minute golden yellow, strongly refractive hardened drops of some resinous substance which must have exuded from the epidermis.

Loc.: Jodhpur: Barmer (No. 6943 !), on rocks. Loharki (No. 6942 !, 6994 !, 6945 !), seems to be a rare plant.

Fl. and fr. in Nov.

Dalbergia L. f.

Dalbergia sissoo Roxb. Hort. Beng. (1814) 53.
Loc.: Jodhpur (No. 7236 !).
Distrib.: Said to be wild in Gujarat.
Fr. in Oct.

Pongamia Vent.

Pongamia glabra Vent. Jard. Malm. (1803) 28.
Loc: Jaisalmer: Bada Bag (No. 7237 !).
Distrib.: Throughout Trop. Asia and the Seychelles.

II. Caesalpiniaceæ.

Parkinsonia Plum.

Parkinsonia aculeata L. Sp. Pl. (1753) 375.
Loc.: Jodhpur (No. 7238 !). Jaisalmer, near lake (No. 7239 !).
Distrib.: Trop. America. Naturalized in many parts of India.
Fl. in Nov.

Poinciana L.

Poinciana elata L. Cent. Pl. II (1756) 16.
Vern. N.: Sanesra (Macadam).
Loc.: Jaisalmer, near town (No. 7240 !, 7241 !). Frequent in the plains of Jodhpur and Jaisalmer (Macadam). Planted.

Cassia L.

Cassia obovata Collad. Hist. Cass. p. 92, t. XV, A (*Cassia obtusa* Roxb.)
Vern. N.: Goral.
Loc.: Jodhpur: Jodhpur (No. 7242 !), Balarwa (No. 7243 !). Jaisalmer: Sodakoe dunes No. 7244 !), 15 miles E. of Jaisalmer (No. 7245 !). Jaisalmer (Macadam). Devikot (Macadam).
Distrib.: W. India, Sind, Arabia Palestine, Egypt, Nubia, Eritrea, Abyssinia, Kordofan-Sennaar, Somaliland, Senegambia, Angola. Hereroland.
Fr. in Oct. and Nov.
Cassia auriculata L. Sp. Pl. (1753) 379.
Vern. N.: Anwal, Awal —Tanner's Cassia.
Loc.: W. Rajputana (King).
Distrib.: India Ceylon.
Cassia Kleinii W. & A. Prodr. (1834) 293.
Loc.: Jodhpur: Balsamand (No. 7247 !).
Distrib.: India, Ceylon, Java.
Fr. in Oct.

Tamarindus L.

Tamarindus indica L. Sp. Pl. (1753) 34.
Loc.: Jodhpur, Fort (No. 7243 !). Jaisalmer: Amarsagar (No. 7244 !).
Distrib.: Tropics generally, probably indigenous in Africa.
Fl. in Oct., fr. in Nov.

Bauhinia L.

Bauhinia sp.
Loc. Jaisalmer: Bada Bag (No. 7246 !), Amarsagar (No. 7245 !).

III. Mimoseæ.

Prosopis L.

Prosopis spicigera L. Mant. (1767) 68.

Vern. N: Kejra.

Loc.: Jodhpur: Balarwa (No. 7253!). Jaisalmer: Bap (No. 7249!), Loharki (No. 7247!), W. of Loharki (No. 7255!), N. of Jaisalmer (No. 7251!), Amarsagar (No. 7248!, 7250!, 7252!), Vinjorai, sandy plain (No. 7254!).

Distrib.: India, Baluchistan, Afghanistan, Persia.

Fl. in Nov.

Note: This is a very variable plant. In its young state the stipules are often larger than the leaflets (nearly 1 cm. long), ovate acuminate or oblong acute, very oblique, slightly cordate, especially if the plant grows in the neighbourhood of water. As it grows older the stipules become smaller and caducous, and at last vanish altogether. The cultivated tree has much larger leaves than the wild one. The latter is always strongly armed, and more so in dry soil, whilst the cultivated plant is finally almost or quite unarmed.

Uses: The pods are eaten as a vegetable and valued as a fodder. In severe famines its bark is eaten. The wood is used for building purposes, wells, etc., but it is not very good. The tree is held sacred by the Bishnois (Macadam).

Dischrostachys DC.

Dichrostachys cinerea W. & A. Prodr. (1834) 271.

Vern. N.: Kolai.

Loc.: W. Rajputana (King).

Distrib.: Indo-Malaya, N. Australia.

Mimosa L.

Mimosa hamata Willd. Sp. Pl. IV (1805) 1033.

Loc.: Jodhpur: Kailana (No. 7263!), Balsamand (No. 7260!), Osian (No. 7257!), near Badka (No. 7258!). Jaisalmer: Amarsagar (No. 7256!, 4803!), Vinjorai (No. 7262!, 7261!), Devikot (No. 7259!).

Distrib.: India.

Fl. and fr in Oct. and Nov.

Uses: Half a tola of the seeds pounded and boiled in buffalo milk is taken as a tonic against weakness, but must not be taken in excess.

Mimosa rubicaulis Lam. Encycl. Meth. I (1783) 120.

Vern. N.: Hajeru, Janjani, Jijania.

Loc.: Rocky places about Jodhpur and Jaisalmer (Macadam).—We have not seen this species, and it is possible that Miss Macadam has mistaken *M. hamata* for *M. rubicaulis*.

Distrib.: India, Afghanistan.

Acacia Willd.

Acacia arabica Willd. Sp. Pl. IV (1805) 1085.

Vern. N.: Babul, Bambul, Bawal.

Loc.: Jodhpur: Kailana (No. 7264!), Jaisalmer: Bada Bag (No. 7266!, 7265!).

Distrib.: Natal, Trop. Africa, Egypt, Arabia, India, Ceylon.

Fl. in Oct., fr. in Nov.

Uses: The wood is used for building purposes, for tooth brushes, charms, etc. The pods are gathered and given as fodder to goats. The bruised leaves are applied to sore eyes in children. A gum exudes from the stem in the cold weather which is considered unwholesome as food, but is used medicinally (Macadam). Adams mentions the following preparation against asthma: Gum of *Acacia arabica* and honey, one tola each, juice of *Calotropis procera* one quarter of a tola, and fine "Pili earth"; to be taken thrice a day as pills.

Acacia senegal Willd. Sp. Pl. IV (1805) 1077.
Vern. N.: Kumat (Macadam).
Loc.: Jodhpur: Kailana (No. 7272!), Osian (No. 7270!, 7268!), Barmer, rocks (No. 7267!). Jaisalmer: N. of Jaisalmer (No. 7271!), Vinjorai (No. 7269!). Common everywhere, one of the chief jungle forming trees.
Distrib.: Trop. Africa, Arabia, Baluchistan, India.
Fl. and fr. in Oct. and Nov.
Note: The leaves in our specimens are much longer than given by Baker and Cooke, but agree with the illustration given by Brandis. The lateral spines vary, and the pod is broader than usual.
Uses: A gum which exudes from the stem in the cold weather is eaten and sold. It is the commercial gum-arabic. The seeds are valued for food (Macadam).

Acacia catechu Willd. Sp. Pl. IV (1805) 1079. var. *sundra* Prain, in Journ. As. Soc. Beng. LXVI (1898) 508-510.
Vern. N.: Khair.
Loc.: Jodhpur (ex Adams).
Distrib.: India.

Acacia jaquemonti Benth. in Hook. Lon. Journ. Bot. I (1842) 499.
Vern. N.: Bhu bavali, Bawal, Babul, Bambul.
Loc.: Found at Jodhpur and Jaisalmer, less common than *A. arabica* (Macadam).
Distrib.: Gujarat, Rajputana, Punjab, Sind.
Uses: The wood when burned gives out an intense heat and is therefore employed by gold and silver smiths.

Acacia leucophloea Willd. Sp. Pl. IV (1805) 1083.
Loc.: Jaisalmer State (Erskine). W. Rajputana (King).
Distrib.: India.

Albizzia Durazz.

Albizzia lebbek Benth. in Hook. Lon. Journ. Bot. III (1844) 87.
Vern. N.: Siris.
Loc.: Jodhpur: Jodhpur (No. 7273!). Jaisalmer: Amarsagar (No. 7274!).
Distrib.: Trop. and Sub-trop. Asia and Africa.
Uses: The wood is perishable and not much used. The bark is mixed in hot water with *Commiphora mukul* and given to sick camels. (Macadam).

Leucæna Benth.

Leucæna glauca Benth. in Hook. Journ. Bot. IV (1842) 416.
Loc.: Jodhpur: Balsamand (No. 7275!).
Distrib.: Probably indigenous in Trop. America.
Fl. in Oct.

Pithecolobium Mart.

Pithecolobium dulce Benth. in Hook. Lon. Journ. Bot. III (1844) 199.
Loc.: Jodhpur, cultivated in the sands, grows rapidly when watered during the hot weather (Adams).
Distrib.: A native of Mexico.

(*To be continued.*)

THE BIRDS OF PREY OF THE PUNJAB.

BY

C. H. DONALD, F.Z.S.

PART I.

In the last Volume of the Journal (Vol. XXV, p. 231) appeared a paper on the Raptores (Birds of Prey) of the Punjab, in which I divided up the various species into 8 types, to simplify identification. While adhering to the nomenclature and the numbering in the Fauna of British India, Vol. III, I changed the sequence to suit my types. The paper has been very kindly received by many of our members and has evidently met with a certain measure of success, as I have been asked by several, to go into further detail and describe each individual species on the lines of my original paper. In that paper I pointed out that there was nothing, or very little original matter, so far as keys and descriptions were concerned, and the same remark may here be reiterated. I have taken most of the descriptions and keys from the Fauna of British India and from Hume's "Scrap Book of Rough Notes," as also measurements. In some cases I have inserted them word for word, and in others just enough has been taken to suit my purpose.

It is not in any way implied that the keys and descriptions here given are an absolutely sure guide, in every case. Individuals may occasionally be found which cannot be placed in their proper species from these papers, but they will be abnormal specimens, and in, perhaps, 95 per centum of cases the keys and descriptions will suffice to place any Bird of Prey which occurs in the Punjab.

The various changes in plumage which the Raptores undergo, from time to time, makes it practically impossible to describe each and every phase, and specimens might easily be found which even defeat the descriptions given in the two above mentioned works, good as they are. So far as colouration is concerned the descriptions here given will be found considerably wanting in detail, as my endeavour has been to merely give a fair idea of what the bird looks like in general, and depend for identification almost entirely on other characteristics which do not undergo changes.

Out of 82 species of the Raptores to be found in India, Burma and Ceylon, at least 56 are to be found in the Punjab, either as residents or winter migrants, and it is more than possible that others again, hitherto unrecorded, may occasionally find their way into the Province. That some species have considerably increased their range since Hume's "Rough Notes" made their appearance, is very probable, for instance, the Large Spotted Eagle (*Aquila maculata*), while the record of others is possibly due to error, and controversies have not been uncommon, between ornithologists, as regards the occurrence of certain species in particular localities. Hume, for instance, is very sceptical regarding the occurrence of the Golden Eagle (*A. chrysætus*) near Kotgarh, in the Simla District, and in fact considers the species sufficiently rare not to deserve a place in the Fauna of India at all, whereas Stoliczka considered the Golden Eagle by no means rare in the vicinity of Kotgarh, and my personal experience has been that it is to be found practically throughout the Himalayas, in suitable localities, from Kashmir to Garhwal and probably a good deal further east still.

A good deal of valuable data has been lost to science through sportsmen and ornithologists not being able to recognise the various species they have met with, on the wing. It is not always possible to shoot every specimen met with, for identification, and nor is it desirable, but it is possible to recognise a very large percentage of the Birds of Prey on the wing, with a little practice, and the art once acquired enhances considerably the study of, and the interest in, the various species met with.

An attempt has been made in these papers to describe the appearance of each species on the wing, but the task is rather too ambitious and the shortcomings only too obvious.

I trust, however, that the descriptions give some idea of the writer's meaning, and will be found helpful to those who feel disposed to identify birds by their flight and appearance, in the air.

TYPES A, B & C.

This chapter deals with the Types A, B, C of the Birds of Prey of the Punjab. These three types comprise between them the Osprey, the Lammergeyer, the Vultures and the Scavenger Vultures, in all some seven genera and eleven species and all birds of from medium to very large size. Of these again, Types A and C. comprise but one species each, the remainder all going to Type B.

Neither the Osprey nor the Lammergeyer can possibly be mistaken for any other bird of prey. The curious reversible toe, in a foot in which all the claws are all more or less the same size and no aftershaft to contour feathers are two characteristics which, in themselves, place the Osprey apart from all other diurnal birds of prey. I say diurnal, because the Osprey shares both the above characteristics with the nocturnal birds of prey or Owls, but as it cannot possibly be mistaken for an owl, we need not go into the differences between them. The Osprey also has very long wings, the tips in the closed wing being equal to or even exceeding the tip of the tail.

The Lammergeyer, on the other hand, can at once be differentiated by his beard. An unmistakable beard of stiff black bristles depending from the chin is the distinguishing mark of this species.

The Vultures though unmistakable as such are not so easy to differentiate from each other, but, on the whole, the characteristics of each species are sufficiently well defined to make their identification fairly simple, from a careful study of the keys.

Two of the Vultures here included are doubtful inhabitants of the Punjab, but as it is quite possible that stragglers occasionally do occur, within the boundaries of the Province I shall give them a passing notice.

All the True Vultures are birds of large size with a head devoid of feathers and covered only with down or entirely naked.

The Cinereous Vulture is the only one which has fur-like feathers on the head and sides, which, at a short distance, give the bird an appearance of a feathered head, but on closer investigation it will be found that they are not true feathers and, moreover, grow in patches and the whole head and neck are by no means covered. Since all other Raptores have their head and neck fully covered, any bird with head or neck bare, or even partially covered, can be straightway classed as a Vulture or Scavenger Vulture and searched for in Type B.

From the keys given it will be found very simple to place any bird in its proper Type and that done, in most cases, the species will not be found to be any more difficult, with a very few exceptions. As I have already said the Osprey and the Lammergeyer are absolutely unmistakable, so for an example let us take some bird in Type B. We know it belongs to Type B because it has a head and neck either covered with down, bare, or covered with fur-like feathers in patches, thus always leaving some part of the head or neck bereft of feathers. We look at the key to the species under Type B and find there are 9 to choose from in 5 genera. Nostril round and head and neck covered with blackish fur-like feathers, and tarsi covered with dense silky down on their upper portion; tail of 12 feathers, and the bird must be *Vultur monachus*. If it has wattles depending from either side of the neck, it must be *Otogyps calvus*.

A tail of 14 feathers and it can be consigned to the genus *Gype*, which also has a narrow vertical slit for a nostril. Two species of this genus are very large birds, and if the wing measures over 27″ you know it must be either *Gyps fulvus* or *G. himalayensis*. If so, the 3rd primary being the longer and narrow shaft stripes on lower plumage will point to it being "fulvus" and the 4th primary longest and the shaft stripes broad, will determine your bird as *G. himalayensis*. If the wing is under 26″ the specimen will belong to one of the other two species, and to find out which, see whether it has any hairs on the crown of the head or whether it is absolutely naked. A vertical narrow slit for a nostril, but a tail of 12 feathers points to the Genus *Pseudogyps* and the species *P. bengalensis*.

The Scavenger Vultures are infinitely smaller being 9″ or 10″ less in length than the smallest of true Vultures.

The difficulty in identifying one from the other of these two species, in certain phases of plumage must always be considerable, as the colour of the beak and the extra one inch or so in length is no criterion, when dealing with immature birds. It is a doubtful point whether each deserves specific rank, they are so closely allied to each other. *N. percnopterus* is our Punjab bird, and though *N. ginginianus* might easily be found in the southern portion of the Province, adjoining Delhi, above that it will usually be the former that is met with.

KEY TO THE TYPES.

Chapter 1.

Type.	*Size.*	*Characteristics.*
A.	Medium. (The Osprey).	a. Head and neck feathered; b. tarsi naked; c. outer toe fully reversible; d. no aftershaft to contour feathers; e. tip of primaries in closed wing reaching to end of tail or exceeding it.

Type.	*Size.*	*Characteristics.*
B.	Very large to medium. (The Vultures).	a. Head and neck naked or covered with down or partially covered with fur-like feathers and down ; b. tarsi naked or upper portion covered with silky down.
C.	Very large (The Lammergeyer).	a. Head and neck fully covered with feathers ; b. tarsi feathered to the toes ; f. beard of black bristles depending from the chin.

KEY TO SPECIES IN TYPES A, B & C.

Type A.	*Pandion haliætus*, The Osprey.		The same as for Type above.
,, B.	*Vultur monachus.* The Cinereous Vulture.		Head and neck partially covered with black fur-like feathers ; tarsi covered with dense silky down in front and at sides on upper portion, Nostril round ; tail of 12' feathers.
,, B.	*Otogyps calvus*, The Black Vulture.		Head and neck bare, fleshy wattles depending from either side of the neck. Nostril oval ; tail of 12 feathers.
,, B.	*Gyps fulvus*, The Griffon Vulture.	Nostril a narrow vertical slit: size from 35" to 48" in length.	Larger, wing 27" and over ; 3rd. primary longest ; lower plumage with *narrow* shaft stripes. Tail of 14 feathers.
,, B.	*Gyps himalayensis*, The Himalayan Griffon.		Wing over 27" ; 4th. primary longest ; lower plumage with *broad* shaft stripes. Tail of 14 feathers.
,, B.	*Gyps indicus*, The Indian Long-billed Vulture.		Smaller, wing 25½" ; crown of head with scattered hairs. Tail of 14 feathers.
,, B.	*Gyps tenuirostris*, The Himalayan Long-billed Vulture.		Wing 25½" ; crown of head naked. Tail of 14 feathers.
,, B.	*Pseudogyps bengalensis*, The Indian White-backed Vulture.		Tail of 12 feathers : wing under 25".
,, B.	*Neophron ginginianus*, The Smaller White Scavenger Vulture.		Bill yellow in adults ; length about 24 Nostril a narrow *horizontal* slit.

Type B. *Neophron percnopterus.* The Large White Scavenger Vulture.	Bill dark horny at all ages; length about 26″; Nostril a narrow *horizontal* slit.
„ C. *Gypætus barbatus,* The Lammergeyer or Bearded Vulture.	Characteristics same as for Type above.

Family PANDIONIDÆ.

Type A.

Genus *Pandion* (contains a single species).

No. 1189. *Pandion haliætus,* The Osprey.

Characteristics. Size medium; head feathered; tarsi naked; tip of feathers in closed wing exceed end of tail, outer toe reversible; no after-shaft to contour feathers. The two last named characteristics are in themselves sufficient to place the Osprey and differentiate him from every other diurnal Bird of Prey.

Colouration. Generally deep brown and white. Head, neck and the under-parts (except the upper portion of the breast), white. Conspicuous brown shaft stripes appear in each feather in the middle of the crown and on the nape, and sometimes on the sides. A broad dark brown band extends from the eye down the side of the neck. The whole of the back and tops of the wings a glossy brown, as also the tail, the latter with bars of paler brown above and white below. These tail bars become fainter with age and are said to disappear in very old birds. The upper breast is brown, the feathers having dark shaft-stripes and very pale or white edges. The under-part of the wing is brown with an admixture of white or fulvous.

Legs and feet pale greenish or yellowish; claws black; irides bright yellow; Bill black; cere, gape, and eyelids dull greenish blue (Blanford).

Length 20″ to 22″; wing 20″; tail 9″; tarsus 2·2″; bill from gape 1·6″; expanse about 5 ft.

Distribution. Throughout India in suitable localities.

The Osprey though by no means common, is still pretty frequently met with along the banks of any of the Punjab Rivers and larger streams.

On backwaters and jheels they might be found circling some 50 feet or so above the surface of the water, or sitting on a stump or on an overhanging branch of some convenient tree, with eyes intently fixed on the water below. The usual mode of hunting, of the Osprey, is to fly up and down with slow deliberate beats and every now and again stop and hover. If a fish happens to be fairly close to the surface he will drop with closed wings, head foremost into the water, and like a King-fisher, go right under. If nothing is to be seen, he will move on to repeat the process elsewhere. Almost invariably when rising from the water, after his dive, he will be seen to almost stop in mid air, for a fraction of a second and a spasmodic quiver will be seen to pass over his body from head to tail, to shake off the water, before he continues his flight.

The Osprey is seldom found soaring like the other Fish Eagles, except for short periods, evidently for the purpose of rising high enough to look over the surrounding country for a fresh pool or stream. He is a cold weather visitor to India, though some appear to remain and build in the Himalayas.

The nest of this bird is said to be a structure of twigs from the thickness of a man's finger to that of his wrist, and lined with the softer kinds of sea-weed and some 15 feet in circumference.

Mr. Hume records a nest which he saw in Kumaon, but gives no description of it, and Mr. Thompson says he believes its nest is to be found on the Ganges above Hurdwar. Also *vide* B. N. H. Soc., Volumes XIV, p. 556 and XXI, p. 268.

I have seen the bird in July on the Beas River, in the Kangra District, but have never come across a nest.

Blanford describes the egg as white, much spotted and blotched with dull red, and measuring about 2·4″ by 1·7″. They are said to be more oval in form than any of the Falconidæ and almost invariably three are laid, though four have been found in a nest.

FAMILY VULTURIDÆ.

TYPE B.

Genus *Vultur.*

No. 1190. *Vultur monachus*, The Cinereous Vulture.

Characteristics. Size very large. Top of head, lores and cheeks covered with black fur-like feathers and down. Nostril round; tail of 12 feathers; no wattles depending from side of neck.

Colouration. Rich chocolate brown throughout, sometimes with a ruddy gloss. Under-parts frequently very much darker than the back. This bird varies from a rich brown to almost black, depending on age, the young birds being the paler. Wing quills black.

Bill blackish brown, darker on upper mandible and tip of lower, paler at sides of upper mandible and base of lower. Cere, gape and the extreme base of lower mandible a pale mauve, sometimes tinged with pink, the bare portion of the tarsus and the feet are creamy or dull white. Irides brown. Naked skin of neck livid flesh colour. The upper portion of the tarsus is covered with a dense silky fur in front and on the sides, almost, but not quite meeting behind.

Length 42″ to 45″; wing 30″; tail 17″; tarsus 5″; expanse 96″ to 118″.

Distribution. Throughout the Punjab.

Habits. This fine vulture, though met with all over the Punjab, is nowhere very common. It is easily recognised on the wing by its great size and uniform deep brown colour. The flight is typically vulturine, the wings being held on the same plane as the body with no tendency to turn upwards, except at the extreme tips.

If seen rising from the ground it will be found to have a very slow deliberate beat. More often found alone or in pairs than in the company of other vultures, though it frequently consorts with them in the vicinity of a butchery or round a carcase. Mr. Hume says it is one of the commonest vultures in the Hissar District and he has seen as many as 20 of them with a few of the plains representatives. He considers this species, in the cold weather in the northern portion of the Punjab, to be very nearly as common as the Indian White-backed Vulture. Very occasionally this species might preponderate over a carcase, but, as a general rule, I do not think it can be considered a common bird.

Though this bird undoubtedly does breed in the Punjab there is no authentic record of a nest having been found. Hutton mentions having seen an uncompleted nest in the Doon, with a bird sitting on the branches alongside. A month later the nest was again visited and found completed, but there was nothing in it and no sign even of the birds, and other similar nests in the immediate vicinity were also deserted, due, he thinks, to the fact that the grass below the trees had been recently fired. Major T. E. Marshall, R.E., records the finding of nests and eggs near Quetta, as also Co.. Delmé-Radcliffe, B. N. H. Society's Journal, Volumes XV, p. 351, XXI, p. 264 and XXII, p. 394.

This species is said to build on very high trees or on cliffs, in Europe, during February and March, a huge nest of sticks, and lays a single egg, rarely two, richly marked with dark-red and measuring 3·7 × 2·6.

FAMILY VULTURIDÆ.

TYPE B.

Genus *Otogyps*.

No. 1191. *Otogyps calvus*, The Black or Pondicherry Vulture.

Characteristics. Size very large. Head bare except for scattered hairs on nape, sides and throat. Nostril oval; tail of 12 feathers; *fleshy wattles* depending from the sides of neck.

(*N.B.*—The head in the young bird is covered with down.)

Colouration. Generally glossy black; brownish on scapulars, lower back and rump. Crop patch dark-brown almost surrounded by white down. Thighs white and downy.

The young bird is a deep brown, with whitish under tail coverts and the feathers of the underparts with paler edges. The crown of the head is covered with white down.

Bill dark-brown; cere, skin of head and neck deep yellowish red, a conspicuous naked patch on each side of the crop and a large naked oval area in front of each thigh, the same (Blanford). Mr. Hume says that the bare portions of the neck, legs and conspicuous thigh patches always become more vivid towards the breeding season, and are brighter in the male than in the female, at this season.

Legs dull red ; irides red-brown.

Length 30 to 33″; tail 10·5″; wing 23 ; tarsus 4·5″; expanse 80 to 88.″

Distribution. Throughout the Punjab, not common.

Habits. This bird, often called the King Vulture or the "Turkey Buzzard," the latter erroneously, is unmistakable either on the ground or almost at any height up in the air. The red wattles and fleshy appearance of the whole head, combined with his very dark colouring, are in themselves sufficient to set him apart from any other vultures among whom he may be found. In the air, the white thigh patches are distinguishable at a great height. In flight, too, he is very different, to all the other vultures and when soaring carries his wings more like a Golden Eagle than a vulture, *i.e.*, held well above the plane of his body. From below he looks uniformly black except for the crop and thigh patches, and in some, there is a thin white line running along the centre of the wings, from the body almost to the base of the primaries.

The Black Vulture is only "King" of the carcase when none of the previous species or Griffons happen to be about. He drives all other species from the banquet but is himself driven off by the two above mentioned.

They build on trees, a huge platform of sticks, lined in the centre with leaves and often rags.

Mr. Hume describes a nest which he demolished, which weighed over 8 maunds (6 hundredweight), which had three distinct layers and had been used many times. Unlike some of the other species, they do not nest in companies but are more solitary in their nesting arrangements, two pairs very seldom nesting on the same tree.

It is not uncommon to see them mating in the air. Of this Mr. Hume says : "I rather suspect that these birds pair in the air. Just before the breeding season, a pair may be seen to tower, and, then, one apparently getting on the back of the other, both come with plunges and flappings of the wings, nearly to the ground, when separating they sail away, very slowly, towards some large tree where they both rest." The sight is by no means uncommon, but I cannot say I have ever seen the one getting on to the back of the other. It has always appeared to me that as they tower, their claws interlock and they descend, as Mr. Hume says, "with plunges and flappings of the wings" towards the ground, with their claws still interlocked. This proceeding is somewhat different to that adopted by the Himalayan Griffon, in particular, though the present species may also be seen indulging in it. This is for a pair to sail so very close to each other that at the time it would almost seem as though one was sitting on the back of the other.

Both have their pinions full spread and no movement whatever is visible in either wing or tail while they are one above the other.

A pair might often be seen proceeding for quite a long distance, one directly above the other, occasionally separating for a few seconds and then coming together again, but I do not think they actually touch each other.

The Black Vulture is said to lay sometimes two eggs, but this is not Mr. Hume's experience, who has never found more than one in a nest, out of numbers that he has examined. The egg is pure white, with a very faint greenish tinge sometimes, but very rarely, streaked or spotted, and measures 3·34 by 2·6.

FAMILY VULTURIDÆ.

TYPE B.

Genus *Gyps* (contains 4 species).

No. 1192. *Gyps fulvus*, The Griffon Vulture.

Tail of 14 feathers.

Characteristics. Size large; 3rd, primary longest: lower plumage with *narrow* shaft stripes.

Colouration. The head is covered, top and sides, with yellowish white hair-like feathers, very dense on the top of the head, chin and throat, and thickly intermixed with down, entirely covering the dark skin, and passing into white down on the neck, and covering it entirely, except about one-fifth or so of the basal portion of the back and sides. The feathers of the ruff are whitish, with reddish brown edges, and are elongated and running to a point. The whole plumage of this bird is an admixture of brown to fawn, with a light pinkish tinge, or rufous brown, with narrow shaft stripes of a paler colour than the rest of the feather. The upper wing coverts and tertiaries are a darker brown, as also the crop patch. The underparts throughout are a pinkish brown with narrow shaft stripes, white or whitish.

Younger birds, says Blanford, are deeper coloured and "are distinguished by having the feathers of the back, scapulars, and coverts pointed and the ruff feathers dark and elongate. The buff-coloured birds appear to be either young, or old in worn and faded plumage." Hume, on the other hand, says, "the younger birds are sandier and paler than above described" (the adult) "but the older they grow, the more richly rufous they become."

"Bill horny brown or dusky yellowish, paler on the culmen in adults, greenish horny in younger birds; cere black; iris brownish yellow; legs and feet dirty yellow to greenish grey." (Blanford.)

Distribution. Throughout the Punjab plains and lower hills.

Habits. Similar to other vultures. Builds in cliffs in the hills, in colonies and on high trees in the plains, between February and March. The nest is loosely constructed of sticks, and there is one pure white egg. Very occasionally it is spotted and measures 3·65 by 2·7.

This and the next species, though impossible to separate from one another on the wing, are very easy to differentiate from any of the other vultures, by the amount of white in the plumage.

In the air, the whole bird appears to be a dirty white with the exception of a black edge to the wing quills and a black tail. The amount of black and white on the wings is very nearly evenly divided, the white being somewhat in excess.

The flight is very similar to *V. monachus*, but the wings do not appear to be so broad in proportion to size.

This species as already stated is very similar to the next, and for a long time the two were considered one and the same bird. Mr. Hume, I think, was the first to point out the differences and consider them worthy of conferring specific rank. The chief points of difference are:—*G. fulvus* has a somewhat shorter and stouter bill; is smaller in size; has more down on the head, face, and neck, and is more rufescent generally, than the paler Himalayan variety. In habits, too, there is a marked difference between them, *G. fulvus* building in trees whereas *G. himalayensis* invariably builds in cliffs.

Again, in *G. fulvus* the 3rd, primary is the longest, whereas in *G. himalayensis* it is the 4th, which is the longest.

Measurements. Length 41 to 47″; wing 26 to 29″; tail 13″; tarsus 4·5″, and expanse 94 to 106″.

FAMILY VULTURIDÆ.

TYPE B.

Genus *Gyps.*

No. 1193. *Gyps himalayensis*, The Himalayan Griffon.

Characteristics. Size very large; 4th, primary longest; lower plumage with *broad* shaft stripes.

Colouration. The head, cheeks, throat and chin covered with whitish hair-like feathers and white down on the neck. The basal portion of the back and sides of neck bare, and tufts of down in front of the neck. The ruff at the back of the base of the neck composed of lanceolate feathers about 3″ long, pale brown with whitish centres The whole of the back plumage varies from light brown to white on the lower back. The scapulars and greater wing coverts dark brown with pale tips. Quills and tail dark brown, almost black. Crop brown, the short feathers being pale edged. Under-parts, pale brown or buff with broad whitish shaft stripes. Upper and under tail coverts buff, somewhat lighter below than above.

Bill pale horny green, dusky at tip; cere pale brown; irides brownish yellow; legs and feet dingy greenish, grey or white.

Measurements. Length about 48"; tail 16"; wing 30"; tarsus 4·0"; expanse 106 to 110".

"Young birds are dark brown above and below, with strongly marked whitish shaft stripes on all body feathers and wing coverts, the shaft stripes being very broad on the ruff and the lower parts; wing and tail feathers nearly black." (Blanford.)

Distribution. Throughout the Himalayas.

Habits, etc. This fine bird is common everywhere in the hills from the foot hills at about 2,000 ft. to the borders of Thibet up to almost any altitude. It breeds on almost inaccessible cliffs, usually half a dozen or more pairs sharing the same cliff, though I have seen solitary nests as well. Its nest is the usual platform of sticks and it is not above making use of an old eagle's nest. The egg is sometimes plain greyish white, but more often blotched or streaked with red-brown and measures 3·76 by 2·75.

The breeding season is from December to March, but they commence soaring in pairs quite early in the autumn, and might often be seen sailing one immediately above the other, almost touching, and look as though one is sitting on the back of the other, with wings stretched.

When passing directly overhead, only one bird is visible, so evenly and close to each other do they fly. I have never seen this species tower and descend with claws interlaced, like the Black Vulture or the Lammergeyer is wont to do.

In flight it closely resembles the last species, the adults being always easily identified by the amount of white. The young bird, however, is a deep brown throughout and looks very like *V. monachus*, except that the white round the crop patch and the striped feathering on the under-parts, give it a less uniform colouring than in the latter and the wings too appear to be less broad.

FAMILY VULTURIDÆ.

TYPE B.

Genus, *Gyps*.

No. 1194. *Gyps indicus*, The Indian Long-billed Vulture.

Colouration. Size large. Head and nape sprinkled with short whity brown hair-like feathers, which lower down the neck gives place to irregular tufts of light down.

A distinct ruff of soft white feathers. Back and upper parts varying from light to dark brown, all feathers more or less edged lighter. The underparts pale brown, almost whitish, with broad pale shaft stripes. In the young, head and neck are more thickly clad, and the young resembles the Himalayan Griffon, but is, of course, considerably smaller.

Characteristics. Size large. Nostril a vertical narrow slit; tail of 14 feathers; wing under 25″; crown of head with scattered hairs.

Measurements. Length about 38″; tail 11″; wing 23″; tarsus 3·75″; mid-toe without claw 3·9″; bill from gape 2·8″. (Blanford.)

Bill and cere pale greenish, yellow horny on culmen; irides brown; bare skin of head and face dusky, ashy leaden; legs and feet the same; claws creamy horny. (Blanford.)

Blanford gives the range of this species as "throughout the greater part of the Peninsula of India, south of the Indo-Gangetic plain not in Sind nor in Ceylon."

The Long-billed Vulture is said to breed from December to February in colonies on precipitous cliffs, laying a single egg, greenish white generally unspotted, sometimes spotted or blotched with reddish brown, measuring about 3·61 by 2·72. (Blanford.)

Family VULTURIDÆ.

Type B.

Genus *Gyps*.

No. 1195. *Gyps tenuirostris*, The Himalayan Long-billed Vulture.

Characteristics & Colouration. Very similar to the last species except that in this species the head is bare absolutely. The general colouration of the plumage being darker, the legs and feet somewhat longer, the bill more slender, the nostril apparently less elongate and broader, and the colours of the soft parts different. (Blanford.)

Measurements. Length 38½″; tail 10½″; wing 24″; tarsus 4″; middle toe without claw 4·3″; bill from gape 2·85″.

Bill brownish dusky horny, the culmen yellowish horny; cere horny black; irides deep brown; claws dusky or horny black. (Hume.)

Distribution. "Throughout the lower Himalayas and near their base as far west as Kashmir."

Said to breed on trees in January and February and lays a single egg nearly pure white and measuring 3·5 by 2·73.

Family VULTURIDÆ.

Type B.

Genus *Pseudogyps*.

No. 1196. *Pseudogyps bengalensis*, The Indian White-backed Vulture.

Characteristics. Nostril a narrow vertical slit; tail of 12 feathers.

Colouration. The whole head and about two-thirds of the upper portion of the neck dusky plumbeous with inconspicuous brownish hairs sparsely scattered about, but thicker and longer on the occiput. The upper half of the back of neck densely covered with soft white feathers, followed by a conspicuous ruff of short pure white down.

The upper parts, including tail, varying from black to brownish black, except the secondaries which are a deep brownish grey, and the lower back and rump which are pure white. Underneath, the breast and abdomen are deep brownish black, the feathers with pale narrow shaft stripes. The flanks, lower wing coverts, except near the edge of the wing, axillaries and thigh coverts white. Crop patch black, bordered on each side by white down.

In the young bird there is much more down about, the head and neck, white above and brownish and thinner below. "Ruff of whitish lanceolate feathers with brown edges; plumage generally dark brown, primaries and tail feathers blackish; wing coverts with narrow, breast and abdomen with broad, whitish shaft stripes; no white on back, flanks or wing lining; a white down border to the brown crop patch." (Blanford.)

"Bill dark plumbeous, except the upper part of the upper mandible, which in adults is greyish white; cere horny black, polished; irides brown; naked skin of head and neck dusky plumbeous; legs and feet nearly black."

Measurements. Length about 35″; tail 10″; wing 23″; tarsus 3·75: mid-toe without claw 3·5; bill from gape 2·75 (Blanford.)

Distribution. Blanford records this species as the commonest vulture throughout India and Burma, but not found in Ceylon, nor above moderate elevations in the Himalayas, and rarer in the Punjab and Sind and in the desert parts of Rajputana. Hume, however, considers it plentiful in the major portion of the Punjab, but affecting particular localities for breeding.

Habits, etc. Anybody who has been along most of the older canal banks, lined with "seeshum" or other large trees, must have been struck with the numbers of enormous nests to be seen among the branches, and during the winter months, with one of these vultures sitting on a branch alongside, and perhaps a hideous head, covered with down, looking out from inside the nest.

During the breeding season this is an excessively noisy bird and the "roarings" one hears would do credit to a zoo.

Hume tells of a female returning to a nest, whence he had taken the egg and shot the male, and tearing it to pieces and making a "wonderful snorting and hissing all the while."

It is possible that the distribution of this species in the Punjab has extended considerably since the fauna of British India was written. Flourishing villages having come into existence, canal colonies, where erstwhile was nothing but a sandy waste, ensures a plentiful supply of food, and trees on which they can build.

The flight of this bird is very similar to the other vultures. When flying low and to or from a place the wings are held slightly back, though not so much as in "Otogyps." When soaring, however, this tendency is not so noticeable. It can easily be distinguished from the other four Punjab species, first by its smaller size and in the adult, by the amount of white on its rump.

As this is the last species of the true vultures to be dealt with, it may be as well to give a rough description of the 5 species to be found in the Punjab, and what they look like on the wing, taking of course normal adult birds.

Vultur monachus.	Very large; wings held in a line with the body and apparently very broad; colouring more or less uniform throughout and varying from deep brown in some specimens, to almost jet black in others.
Otogyps calvus.	Large; wings held well above the back; colour jet black with a narrow whitish line running down the centre of each wing (not always very conspicuous); white thigh and crop patches very conspicuous; if at close range, naked livid skin might also be seen near the white patches.
Gyps fulvus.	Very large; wings held in a line with the body, colour throughout very pale dirty white, except the margins of the open wings and the tail which are black. The front half of the bird thus appears pale coloured and the back half black.
G. himalayensis.	Very similar to the above, and the two are not easily distinguishable from each other. This species is a little lighter and cleaner looking on the pale under parts. This species is hardly likely to be found on the plains, whereas the former (fulvus) does not ascend the hills to any great height.
Pseudogyps bengalensis.	Smaller than all except *O. calvus*: wings may be held slightly backward or level with the body: the body dark, wing lining and sides of body white or light coloured and margins of the extended wing blackish. If a view of the back is obtained, a prominent white patch will be seen on the lower portion of the back, the rest of the upper parts appearing almost black.

The White-backed Vulture breeds in trees from about October till March. They usually build in colonies, either several nests on a single tree, or on adjoining trees all along a canal bank. A single egg is laid, generally dull white but sometimes marked with reddish brown and measuring on an average 3·26 by 2·42. (Blanford.)

FAMILY VULTURIDÆ.

TYPE B.

Genus *Neophron*.

No. 1197. *Neophron ginginianus*, The Smaller White Scavenger Vulture.
No. 1198. *Neophron percnopterus*, The Large White Scavenger Vulture or The Egyptian Vulture.

Characteristics. Nostril a narrow horizontal slit; bill slender, and lengthened.

Colouration. The fully adult plumage is almost white throughout, except for the primaries and the winglet which are black; the former are grey outside and brown inside towards the base; secondaries whity brown or grey on the outer web outside, blackish brown elsewhere; tertiaries pale brown throughout. A brownish or greyish tinge on the scapulars and wing coverts and sometimes elsewhere, is a sign of maturity. The neck hackles are often stained rusty. (Blanford.)

"Young birds are at first blackish brown, the scattered down on the head and throat black, then pale tips appear on some of the neck hackles and breast-feathers and on the smaller wing-coverts, giving a speckled appearance; the back, breast, and greater wing-coverts are mottled with whitish blotches. The change to the adult plumage is gradual." (Blanford.)

No. 1197. Bill in adults horny yellow, in young birds dark; cere and sides of head and throat yellow; legs dirty yellow; claws pale horny. In young birds the naked parts of head and throat grey; legs and feet cinereous.

No. 1198. Bill dusky, never yellow; cere is reddish yellow, darker than the cheeks, and the claws blackish horny.

No. 1197. Length about 24"; tail 9·5; wing 18·25; tarsus 3·1; mid-toe without claw 2·5.

No. 1198. Length about 26"; tail 10"; wing 19"; tarsus 3·3; mid-toe without claw 2·6. (Blanford.)

Habits, etc. With regard to the two species here given I have quoted from the Fauna of British India almost word for word, and by placing the numbers in front of the description of the beak, legs, etc., have shown at a glance how very small the difference between the two species is. The latter is generally the more robust bird of the two, and the very small difference in actual measurement of the mid-toe without claw, does not convey what this really means in the foot of the two birds, that of *N. percnopterus* being comparatively a good deal larger than the difference in the decimals of an inch represents.

A common feature of every town and village in India, the Scavenger Vulture is, next to the Kite, the most familiar bird in the country.

In flight it resembles the Lammergeyer pretty closely, except in point of size. Long narrow wings and a wedge-shaped tail proclaim the Neophron from afar. In its adult plumage, it is still more unmistakable, being practically wholly white with a jet black margin to the wings. The young birds may vary from almost a dirty black throughout to various degrees of black and white, frequently in patches, depending on age.

On the wing, the colouring of the under surface is not unlike an adult Griffon, but whereas the black wing margin is interrupted by a white tail in Neophron, it is continuous in the Griffon, the under surface of the tail being black in the latter.

With a light and graceful flight this is a very different bird in the air to the same on the ground, where Mr. Dewar, I think, likens him unto a recruit learning to march.

The Neophron breeds from February to May either in cliffs, trees or old ruins and lays usually two eggs, much spotted and blotched with brownish red and measuring 2·6 by 1·98.

FAMILY FALCONIDÆ.

SUBFAMILY GYPÆTINÆ.

TYPE C.

Genus *Gypætus*.

No. 1199. *Gypætus barbatus*, The Bearded Vulture or Lammergeyer.

Characteristics. Head feathered; tarsi feathered to the toes; a beard of rough bristles depending from the chin; size very large.

Colouration: In adults, the whole head, neck, and the whole of the under-parts white, washed with varying degrees of yellow or gold.

The lores black, and the cere entirely covered by the black rictal bristles, and the beard black.

The upper portion of the back and the smaller wing coverts black with narrow white shaft stripes.

The rest of the upper plumage is a light grey, the edges of the feathers much darker in some birds and the dark edges disappearing with age, the shaft stripe being whitish. The whole of the back and under lining of the wing has a silvery grey appearance, with darker stripes or lines.

The young birds of the year have the whole head and neck black and the rest of the body a deep brown, with some white on the back and often at the base of the tail. More white appears as they advance with age and a 2-year old bird frequently appears altogether parti-coloured, retaining many of its young plumage feathers.

Measurements. Length 44 to 49″; tail 22″; wing 32″; tarsus 4″ expanse about 9 feet.

Habits, etc. The Lammergeyer builds in cliffs in the Himalayas, from November to March and lays usually 2 eggs, sometimes without markings, but usually heavily blotched with reddish markings, and measuring about 3·24 by 2·66.

This is a magnificent looking bird and of apparently great size, but its fine colouring and huge tri-coloured eye account for its noble looks, and its long pointed wings and wedge-shaped tail make it look much bigger than it really is.

Its weight when compared with the Himalayan Griffon, for instance, accounts for the smallness of its egg, when compared with that bird's, and in spite of its expanse, the Lammergeyer only weighs about 12 pounds to the vulture's 18 to 20 lbs.

The stories that have been written and told of this bird's depredations among flocks and herds, would fill an average-sized book, and one can but wonder how they originated. If they were all told of the Imperial eagle one could understand it, as he so closely resembles the Golden Eagle, that the misdeeds of the latter might easily be put down to the former, but in the case of the Bearded Vulture there is no such resemblance to anything, unless it be his still more ignoble cousin the Scavenger Vulture. The fact remains that the Lammergeyer has been blamed for carrying off lambs and accredited with killing ibex and ghooral. One glance at his miserably weak talons precludes any such possibility, and all such stories about him must be put down as myths and traveller's tales without any atom of truth.

Mr. Hume tells how the Lammergeyer has passed over fowls and pigeons placed as a bait for eagles without taking the least notice of them, and I can recall more than one similar instance.

Bones are to a Lammergeyer what chocolate is to a school boy and if it is intended to catch him, the best bait is a collection of bones placed in a circle of nooses.

Bones 2 to 3 inches long and as thick as a man's finger simply disappear down his capacious throat, without causing the least bit of inconvenience. One I kept in captivity, used to be regaled with the legs of fowls and pheasants, tibia and tarsus complete, together with the toes and claws. The whole leg would promptly begin to disappear until just the toes peeped out of the corners of his beak. The old Lammergeyer would then take a breather, and then suddenly draw in his neck, giving it a twist at the same time. There would be a slight "crick" as though his neck had been broken, and the next instant the toes would disappear from view and the bird would be prepared for another leg. Whether this twist and contraction of the muscles of the neck broke the bone inside I cannot say, but it certainly appeared to do so, and the fact remain that the bone invariably went down the more easily.

In his wild state the Lammergeyer is gifted with the patience of Job and is prepared to spend an entire morning in the breaking of a refactory bone that is too big to swallow. I watched one on the Braribal Pass into Kashmir, for well over an hour trying to break his bone. When I arrived on the Pass he was there, and how long he had been at it previous to my coming, I don't know, but I had breakfast not far from where he was performing, and when I left, which was a good hour from the time I arrived, he was still trying to break his bone. The "modus operandi" is as follows :—

Having secured his bone the bird flies up to a considerable height above a boulder strewn nallah or plain, and then drops his bone. If he is fortunate the bone strikes a boulder and breaks, and he follows leisurely down and swallows the pieces, but in the above instance, he either had a particularly tough bone or it never struck a hard enough stone at the right angle.

In the autumn, and in fact from about the beginning of September to the beginning of November, it is a lovely sight to watch a pair of these fine birds mating. One will be seen dropping from the heavens with closed wings till within a few feet of another, on a lower plane. No. 2 turns over on its back to receive the onslaught and No. 1, with a slight opening of the wings and tail, appears to just miss the other, and immediately rises almost vertically up again. Again he attacks, and if he has judged his angle correctly, No. 2 begins a succession of zigzags, dropping fast, with semi-closed wings, but not fast enough to get away from No. 1. As the latter again approaches to within a few feet, No. 2 changes its tactics and opening its wings to their full, begins rising with tremendous beats of wings, closely followed by No. 1. Up the two go for a short distance, the pursuer within a few inches of the pursued, when seemingly, having reached the limit of its endurance, stops flapping and again drops, then sails away. They will then perhaps circle for a short time, rising steadily higher and higher, and once more repeat the process. Sometimes the game ends in their claws interlocking and the pair coming down in a succession of catherine wheels, almost to the ground, when they suddenly part company and forthwith begin to mount up again, or they might simply go on and on, ever rising, until they go clean out of sight over some distant range.

The flight of the Lammergeyer is unmistakable. The long pointed wings, narrow in comparison to their length and the long wedge-shaped tail, are sufficient to proclaim his identity at any height.

The wings, like a vulture's, are held in a line with the body. When quartering a hillside he will be frequently found to fly with his wings half closed, and they will then appear very narrow and long, the end of the long primary feathers reaching to almost, or quite, to the end of the tail, the points frequently lower than the level of the body.

I have never seen a Lammergeyer actually feeding on a carcase with vultures, though he is never far away from it while they feed.

After the vultures leave, he attacks it or before they arrive in any numbers, he gets, a few tit-bits.

(To be continued.)

PANTHERS.

BY

BRIGADIER-GENERAL R. G. BURTON.

I. SPECIES AND VARIETIES.

It is curious that the idea that there is in India more than one species of panther is still prevalent, even in quarters where more enlightenment might be expected. An experienced sportsman only a few years ago produced an interesting book of reminiscences in which he maintained that there were not merely two but three species of panther, and these inhabiting the same districts. He even went so far as to give the name of "pantheret" to the smallest of these supposed species. Certainly the value of his opinions was discounted when it was found that the reasons he gave for these distinctions had been mainly taken from an obsolete work on natural history, but the fact is of importance as showing how even experienced observers may be led astray. These animals range the length and breadth of Africa and Asia, from the Atlantic to the China Seas. I have seen at Nijni Novgorod skins from the Caucasus and from the farthest confines of Siberia. It is only to be expected that with such a vast variety of climate and general environment there should be a considerable variation in minor characteristics. Perhaps the tendency to separate the panther into two species has been accentuated by confusion of nomenclature, *Felis pardus* being called *panther* in some parts of the country and *leopard* in others. The latter name is more properly applied to the hunting leopard.

The older naturalists founded their reasons for a separation of species on differences in size, in texture of fur, and in the shape of the skull. They were even supposed to differ in character, the smaller animal being considered the fiercer. There was said to be a large species characterised by an elongated skull, having a pronounced occipital ridge and a smooth coat. The smaller so-called species was supposed to have a round skull, no occipital ridge, and a rough and less brightly-coloured coat. To these alleged differences Sterndale added that Temminck had noted a variation in the number of caudal vertebræ, and the author above referred to adopted this as a "fact" the larger so-called species being said to have 22 vertebræ and the smaller 28. I have found a mature and medium-sized panther to have 24 vertebræ in the tail, and other sportsmen have noted a similar number, whilst I counted 26 in another. One with 23 caudal vertebræ is recorded from Canara. This difference is, therefore, apparently non-existent, and was probably based on the examination of a very limited number of specimens. Naturalists are prone to separate species on insufficient evidence. Thus the late Dr. Lydekker gave sub-specific status to the Baluchistan gazelle on the evidence of a female head having annulated horns, and the dark portions of the face being dark brown instead of rufous; the male was said to differ from the ordinary Indian chikara in having the horns more curved backwards and slightly more lyrate when viewed from the front. Now it is quite possible that the Baluchistan gazelle may be a local race, but the alleged differences are of no value in determining this. The female chikara in the Deccan has frequently distinctly annulated horns, and the dark portions of the face vary in colour with age. As for the form of the horns, these will be found to vary even in specimens in a single herd in any part of India, some being more lyrate and some more curved back than others.

To return to the panther. Size is no criterion. We might separate the tiger into different species for the same reasons. The distinctions adduced as regards form of skull and texture of fur are merely indications of age and sometimes, in the case of fur, of environment, and are not peculiar to the panther. In older animals one naturally finds more pigmentation, resulting in a brighter-coloured coat. In cold climates thicker and longer fur and an under pelage may be expected. In open country colour is naturally lighter than in dense forest where darker animals are found. The tendency appears to be for coloration to approximate to the environment, as in the desert-born which assimilate to the colour of the soil. While this is an outcome of evolution, its rapid effects may be seen in the case of fish. You will find blue trout in the glacial streams of Norway, and pull black ones from the gloomy depths of rocky pools. There is a species of spider in the South of France which adapts itself to the colour of the flower it frequents, and will change colour in a few days when transferred from one flower to another of different hue.

2. COLORATION.

Panthers from different localities vary considerably in coloration, which in certainly remarkably protective, both by day and in the dusk or at night. I had great difficulty in distinguishing one that I had shot which was lying dead under some bushes where it blended with the chequered sunshine and the shadow of the leaves; and when looking for and expecting to see a panther, I have been on the point of firing at such a chequered patch of sunlight and shadow. At night a panther will flit from shade to shade like some evanescent phantom, even in bright moonlight, and it blends like a shadow with the dusk.

A remarkable skin from the Deccan was described in the *Field* of the 18th January 1908 in the following terms:—"Although the black markings present some approximation in pattern and mode of arrangement to the jaguar type, the head and back are ornamented by an altogether peculiar kind of meshed network of broad buff lines, the first mesh which occupies the head being much larger than all the others." This may be a hybrid between a tiger and a panther, although the note on the subject states that the markings present no approximation to the tiger type, and that tigers are seldom found in the district. The latter reason rather favours the hybrid theory, mating being more likely to occur where the tiger has perhaps wandered far from the haunts of his own species. Such a hybrid is recorded in a book by Mr. Hicks of the Forest Department, but the skin was destroyed and is not described. It is not stated in what district of the Deccan the skin described in the *Field* was obtained. Among panthers which I killed in a district of the Deccan a few years ago was one which slightly approximated to the jaguar type in having a central spot in each rosette on the back. I shot some twenty panthers in that district but this was the only one so marked. The hybrid theory in the instance recorded in the *Field* seems most probable. There have been authentic cases of lions and panthers inter-breeding in captivity, and the tiger seems more proximate to the panther. The skin of a hybrid between a lion and panther, born at Kolhapur, is figured in Volume XXII of the Journal.

3. MELANISM.

It is generally accepted that the black panther is not a separate species but a *lusus naturæ*, a view supported by the fact that litters have frequently been observed containing both black and fulvous cubs. It is, however, curious that melanism in the panther does not occur in Africa, although the species appears to be the same as the Indian one. Black jaguars are found in South America. Moreover, melanism has been proved to be hereditary, but this is only to be expected of this as of many other transmitted characteristics. In the Journal Vol. XVI, Colonel Ferris records the case of a pair of black panthers from North China at Kolhapur which twice bred in captivity and each time produced black cubs. A male bred with a fulvous female; the resulting cub had larger, blacker, and more glossy spots than usual, and the peacock spots altogether larger and more defined. Colonel Ferris thought this pair belonged to a distinct species. They were uniform black, but in the sunlight a faint trace of spots was visible on the sides, and lower down on the belly the spots were more apparent and the hair was of a deep brown. The spots were not, however, "five finger tipped or circular broken rosettes but entirely black blotches without annulation. The tongue was brilliant pink, and the palate of the male pink, but of that on the female there were two small black spots. Under the tongue both were blackish; the gums above and below the front teeth and in which they were set were black". He mentions the case of a black panther shot in Canara having a black tongue; this is an interesting point calling for further evidence. One shot by Colonel Grantham had a pink tongue. The so-called black panther appears to be generally more dark brown than black, and in the sunlight the rosettes stand out plainly.

Black panthers, as one would expect, appear to be more frequently met with in the dense forests of the south, west and north than in other parts of India. They are perhaps more common in the Malay States, where the forests are dense and the climate is moist. I never heard of or saw one in the Deccan, but one was seen in Sironcha, and I heard of one being shot in the Central Provinces. In the Nilgiris and Mysore they appear to be less rare. In a very entertaining book, Colonel Welsh's *Military Reminescences*, published in 1830, it is stated that both black panthers and black tigers were found in the forests of Travancore. The black tigers may be doubted, but Major Capper believes that he saw one in the Cardamom Hills in that State in 1895; and Mr. Hauxwell saw and wounded one, to the best of his belief, in the Bhamo District in Burma in 1913. Dr. Blanford mentions one shot near Chittagong many years ago. This is the black tiger of which a full account was given by Mr. C. T. Buckland in the *Field*. The account was reproduced in Volume IV of this Journal. Mr. Buckland saw the dead tiger, which was killed by a poisoned arrow two miles from Chittagong in March 1846. The skin, which was unfortunately too decomposed for preservation, was black or very dark brown. the stripes showing a darker black in the sunlight. The dead tiger was also seen by Captains Swatman and Hore. In the "Observer" of January 11th, 1811, it is recorded that "a large black tiger, the only one ever seen alive in Europe, intended as a present from the King of Java to Bonaparte, taken in the *Gude Vrow* on the passage to France, is now to be seen at Kendrick's collection of Rare Foreign Beasts and Birds, No. 40, opposite St. James's Church, Piccadilly." But this was more probably a panther, and the case for black tigers, except the Chittagong specimen, is "not proven." In Java black panthers are said to be not uncommon, and one writer has suggested that their colour is due to natural selection for the purpose of facilitating their pursuit of the black gibbons on which they prey. Surely this is the theory of protective coloration run wild.

In a book entitled "The view of Hindustan," by Thomas Pennant, 1798, it is recorded that a black panther, taken in the Sunderbunds, was presented to the Menagerie in the Tower of London by Warren Hastings. Also that "a leopard of a dirty white colour, spotted with grey, taken near Agra," was presented to Jehangir.

Bates, in his "Naturalist on the Amazons," makes frequent mentions of black jaguars in the forests of Brazil.

On the other hand albinism appears to be commoner in the larger feline: I have never heard of a white panther. Dr. Lydekker mentions severa white tigers in his book on the Game Animals of India, and figures the skin of one. A white tiger, killed in the Bilaspur District of the Central Provinces, is described in Volume XXIV of this Journal. It was cream coloured with stripes of chocolate brown.

4. Breeding Habits.

Not much appears to be definitely recorded regarding the breeding seasons of the great felidæ. A panther killed in March had three unborn cubs. I kept a cub some time that was probably born in December, and I saw a cub in February that was five or six months old. There is apparently no regular breeding season. In the *Field* of 4th April 1908 the period of gestation is said to be three months, meaning presumably twelve weeks; that of the tiger and jaguar is put at three and a half months. Like other cats, panther cubs are born blind. They appear to be generally two or three in number.

5. Dimensions.

It has been said that panthers vary greatly in size. I have not my diaries here so cannot give the dimensions of many which were carefully measured. In the Journal No. XXI, page 1063, I gave the measurements of ten shot in the Buldana District of Berar in 1912. These varied in length from a little over seven feet to five feet eight inches, but some were immature. Three old males had a head and body length of 4 feet 6 inches, 4 feet 3 inches, and 4 feet 2 inches respectively. Their tails were 2 feet 9 inches in the case of two, and 2 feet 6 inches in length in the case of the other. Three old females were two of them 3 feet 8 inches, and one an inch less in length of head and body. The variation in size is therefore negligible in these cases, and, to the best of my recollection, in other animals of the species which I have shot. I think these were of average size and it seems probable that mature animals do not vary as greatly in this respect as has been frequently represented. Most length records of tigers and panthers are so inaccurate as to be entirely untrustworthy. Those I have given were measured between uprights placed at the nose and at the root of the tail. If all measurements were taken this way we should probably hear little more of ten-foot tigers and eight-foot panthers. I have never seen one or the other. Measurements taken round the curves of the body are quite valueless. In Volume XX of the Journal the measurement of a panther shot by a villager in Tehri State is given as nine feet three inches. That is the length of an average male tiger, and it may be placed in the same category as the eleven and twelve-foot tigers which we have heard of but never seen. The great cats are very symmetrically built. and if eleven foot tigers and nine-foot panthers are chalked out on a wall in their proper proportions it will be seen that they are more like monsters of the prime of the sabre-toothed species than the real animals of our prosaic age. A large series of skulls may be seen in the Society's Museum, and these perhaps give a fair criterion of size. I have no record of weights, but in Volume XXVI two males are recorded as weighing 114 and 115 pounds, which is probably a fair average. But no doubt much heavier animals are found.

6. Habits.

The habits of these animals are certainly very interesting. Their conduct is frequently characterised by extreme boldness and extreme timidity. Though so bold that they have been known to enter a tent and even a house, they will seldom take their prey in the presence of man when they are aware that they can be seen. Thus a herd of goats watched by a small herd boy will probably be unmolested, but stragglers will be seized.

At hill stations dogs are not infrequently taken when out with their owners, but I do not recollect hearing of the dog being seized actually in its owner's presence. The thief is generally invisible on such occasions. I see in the Journal many notes under the heading "Boldness of panthers". These generally refer to instances of these animals returning to a kill after being fired at once or even oftener. I recollect one returning to the carcase of a nilgai three times, and being fired at each time. I think the authors of these notes are too ready to ascribe almost human powers of reasoning to the panther. It is not likely that the animal is aware that a projectile has been propelled at it, and that it will connect the report of the rifle with an attempt on its life. A friend of mine shot in quick succession three panthers that came to feed on the carcase of a donkey they had killed. Panthers commonly reside in the near vicinity of villages, and become used to the presence of human beings, but even where they are not molested they are seldom seen, although they may be heard prowling in the neighbourhood in the darkness, I recollect one coming to drink at a well in the compound of a forest bungalow where I was staying. My bed was placed outside as it was hot weather and the panther must have passed close to me although I did not see it. A bear came in the same night, and I ran after it bare-footed, but did not get a shot.

I cannot agree with that fine sportsman and naturalist and brave soldier, the late F. C. Selous, who says in his *African Nature Notes and Reminiscences* "nothing is more certain than that all carnivorous animals hunt almost entirely by scent". African conditions may have led to the greater development of the powers of scent in the carnivora. My experience is that tigers and panthers hunt almost entirely by sight, and perhaps partly depend on hearing. This has been proved time and again by these beasts of prey passing close to buffaloes or goats, tied up as bait, without seeing them, owing to the bait having made neither sound nor movement. I have known many occasions when a tiger has passed close to an animal thus tied up, and has killed another a few hundred yards farther on. For this reason, that they hunt by sight and not by scent, one ties up the bait on or near a path or watercourse or near a pool of water, so that the prowling tiger may come upon it during his nightly wanderings.

One may go further and say that the popular notion that these animals have powerful olfactory nerves is a common fallacy. This has been frequently proved by sportsmen sitting in concealed shelters on the ground when a panther will prowl round in close proximity, perhaps only four or five feet off, without detecting the presence of a human being. In the case of panthers having the habit of prowling round human habitations this may not appear conclusive, as it may be thought that they have acquired a character of indifference to the smell of man. But the same thing has been observed in forest-dwellers which prey, not on stray goats and dogs, but on the feral denizens of the jungle.

But the powers of vision of these animals are apparently not very good. They at once detect movement, but fail to distinguish a motionless object. Whiskers appear to help. I saw a panther, driven out below me in noisy beat, using his whiskers very freely; they were set and bristling and moving backwards and forwards. These animals, like tigers, seldom look up, but I have known one, driven out in a beat, attack a man in a tree.

The panther is not as impatient of thirst as the tiger and may be found at a distance from water, but the tiger seldom strays far from stream or pool. The tiger is fond of lying in water during hot weather. I recollect one coming along in the beat dripping from the midday bath. My shikaris averred that this animal, which was undoubtedly unusually addicted to this habit, always lay in water in the heat of the day with nothing but the tip of his tail showing above the surface! I have never known a panther take to water, and they seem to like wetting their fur as little as the domestic cat. Is it that the tiger is an immigrant into the tropics from northern climes, and is accordingly impatient of the heat?

Panthers are comparatively seldom met with by chance, and have to be sought for. I shot one one morning by the side of a forest road where it was sitting up on its haunches like a dog about eighty yards off. A lucky shot hit it in the side of the head. I put up another when out partridge shooting and killed it with a charge of No. 1 shot at very close range. Those are the only two I have met by chance although I have spent months in country infested by them. They are timid and retiring, and no doubt conceal themselves on the approach of a human being. An unwounded panther is not generally a dangerous animal. I have known one kill a woman who came suddenly upon it when she was cutting grass; this panther, which I shot, was not a man-eater; another one seized a man who was lying asleep in the open, wrapped up in a black blanket. It perhaps mistook him for a goat, and it dropped him as soon as he cried out. A remarkable instance of a panther charging a sportsman is given in Volume IX, page 96, of the Journal, where Mr. Millett relates that he was walking in the jungle when the animal suddenly rushed at him from a distance, but swerved aside, just brushing his leg, on being struck on the back with the gun. Probably the panther mistook him at first for lawful game. I have myself nearly trodden on a panther. I was going down a hill covered with sparse jungle when I smelt the animal, and, looking down, saw it lying under a bush at my feet. It rose and walked over the slope into denser thicket where I had thought it to be at first and out of which I then drove and killed it. My chief attendant considered that I had had a very narrow escape, and after our arrival in camp performed a mysterious ceremony, passing a live fowl several times over my head to exorcise the spirit of the beast. When much harried an unwounded panther will, however, turn and rend its pursuers. Some Brinjaras in my service marked down one of these animals under a bush on a hillside. I had already driven this animal out twice in a neighbouring ravine and had fired at and missed it. I now walked up to the place expecting to get an easy shot, but the beast ran down the hill, only giving me a glimpse of its tale over the top. I was accompanied by a number of beaters and followers. We gave chase, the panther flying down the road like a scalded cat, with the crowd in full cry after it. It was now getting on for dusk, and the animal took refuge in a thickly wooded nullah. I quickly organised a beat, but instead of coming towards my post, the panther turned on the beaters some twenty yards from me, and seized a fifteen-year old boy by the back of the head and neck. A sepoy with the beaters fired a shot. I could not fire owing to the crowd, and the panther dropped his victim and dashed back into the jungle. By the time I had picked up the boy and attended to him it was too dark to find the panther, although its position was indicated by a flock of crows cawing in a tree above. This boy was not very severely hurt, the panther fortunately having seized him "lengthways," and its teeth slipped on the skull, the lower canines penetrating the neck to some depth. His head was screwed to one side, but I gradually got it straight in the course of a few days, and he was soon well on the road to recovery.

7. PANTHERS AND THEIR PREY.

The panther appears almost invariably to seize its prey by the throat, and follows the same rule in attacking human beings. But people mauled in this manner are generally seized by the arm or shoulder, which are no doubt presented to the animal in the effort to protect one's self. A wounded panther which seized me got hold of my fore-arm, raised to cover my throat. When its weight bore me to the ground, it seized and bit deeply into the thigh placing one paw on the calf of the leg which the claws penetrated. Nearly all the men I have seen mauled have been seized by the arm or shoulder. Those attacked by man-eaters are taken unawares and come under a different category, and are usually seized by the throat; but I recollect the case of a woman being dragged by the leg out of the verandah of a house where she was sleeping.

How does the panther attack and kill its prey? We read everywhere of the great carnivora "springing" on their prey. From a position above the quarry it is probable that a spring will complete the stalk. But in my experience these animals run rapidly on to and rush up and seize the victim. The panther above referred to that attacked me came rapidly *ventre-a-terre* uttering low growls: there was no "spring," and I have never seen such action; but the attacks I have seen have generally been by wounded and angry animals. A panther took a goat within ten yards of a tree in which I was watching for him. A wooded nullah was close by. From this the panther rushed in broad daylight and seized the goat by the throat at the same time clasping its forequarters with paws: I fired on the instant hoping to save the goat's life and the panther dropped dead beside its victim. The goat was not borne to the ground and the neck was not dislocated, but the fatal fang holes were in the throat, from which the life-blood was welling. As regards prey, few animals came amiss to the panther. Of wild animals he kills many pig, nilgai, and deer; hares and peafowl are caught; in a district where I have found more panthers than elsewhere, the Indian antelope was a common prey, the does falling victims more often than black bucks. Of domesticated animals, calves, donkeys, ponies, dogs and goats are common victims. Having killed its prey the panther drags it away and devours it at leisure under a tree or bush, or sometimes conceals it in the fork of a tree. Unlike the tiger, which begins eating the haunches, the panther begins at the pelvis as a rule and works up to the chest. I have, however, known a panther begin eating at the haunch of a buffalo calf, of which the tail was also bitten off. The kill may not infrequently be found covered with dead leaves to conceal it from vultures, which hunt by sight, or placed in the fork of a tree for the same purpose. I have seen the remains of a barking deer thus deposited in the fork of a tree some eight feet from the ground. In the *Field* of the 24th February 1906, it is recorded that a full-grown chital stag was found eight feet up in a tree where it had been placed by a panther; and a note in the Journal No. XVIII, page 195, relates how a half-grown boar was found similarly placed at a height of twenty feet from the ground. The body of a Brinjara boy killed by a panther was found five feet up in the fork of a mohwa tree; the skull, stripped of flesh, lay in an adjacent nullah. In fact, panthers are good tree-climbers, but their habits are apparently not as arboreal as those of the jaguar. I shot one which was said by the local inhabitants to prey on the langur monkeys which lived about a neighbouring temple and the surrounding trees. They said that it used to chase the monkeys in the evening. I saw these same langurs playing leapfrog exactly like a pack of schoolboys; perhaps in celebration of the death of their enemy! In Volume XV, page 516 of the Journal, Major Mosse gives an interesting account of a panther taking to a tree when driven out of long grass, but not for purposes of concealment, as the tree was destitute of leaves. I found the remains of a monkey in the stomach of a panther, and a sportsman tells of a monkey so killed in Volume XVI, page 754. A native told him that he saw the monkey caught; the panther held on to the branches with one forepaw and drew his prey up with the other. A Brinjara told me of a much simpler way the panther has of catching monkeys. On moonlight nights he walks under the trees where the monkeys are roosting on the branches above. He selects his monkey among the shadows cast on the ground beneath, and pounces upon it, whereupon the unhappy sleeper falls into the jaws of the prowler below, who thus snatches at the shadow and grasps the substance! It has been said that monkeys will swear only at tigers and panthers. I have known them use very bad language at a bear.

8. PANTHERS AND WILD DOGS.

Panthers have been known to take men out of trees, and they take to trees when hunted by wild dogs. In Volume V, page 191, Mr. Wright, late of the Berar Police, relates how he found two panthers in a *salai* tree, one above the other, with a large pack of ten or twelve jungle dogs moving about below. The upper panther was resting upon a branch, and the lower one holding on perpendicularly. "The difficulty was to approach. It was arranged that *C* should go above and have a shot while I went below. After a bit the lower panther made a jump, pursued by the pack in my direction on the bank, but he broke up a ravine. Just then *C* shot the other panther dead, but he stuck in a lower fork when he fell. Some of the pack immediately came back and could be seen standing on their hind legs and licking the blood as it steamed from the beast out of reach. The panther shot was a fine male about seven feet in length." Some twenty years ago one of my buffaloes, tied up for tigers, was killed by a panther. When visiting the kill I found an old wild dog and a pup on it. My men afterwards said they saw the panther going off over the hills with a pack of wild dogs in full cry after it.

9. PANTHERS AND PORCUPINES.

The great carnivora have few enemies besides man. Panthers have been known to be killed by crocodiles; a fight between a panther and a hyena is described on page 519, Volume XIX of the Journal; in this, the panther was the aggressor but not the victor, though neither of the combatants appears to have been damaged. In another fight between two of the same animals the panther was killed by a hyena whose cave it had entered when slightly wounded. In both these instances the combatants were females. Panthers and tigers both frequently prey on porcupines, and very often have quills sticking in their paws or other parts of the body. I once shot a tiger which must have rolled over a porcupine for there were quills in the back of his neck, which my shikaris would have it were discharged by the porcupine like arrows from a bow! The late Major Rodon found a freshly dead panther in a Mysore forest in 1895 with a number of porcupine quills sticking in various parts. One paw was in its mouth, and a number of quills sticking in the throat had apparently caused the animal's death. At a short distance behind the panther he found a large number of quills and a good deal of blood. An instance of a porcupine attacking a dead panther is given in Volume XXIV, page 187 of the Journal. Over five dozen quills were picked out of the panther. The writer of the note remarks on the deliberate way in which the porcupine had walked round the panther and filled him with quills both before and behind. Porcupines are no doubt aggressive animals. A goat I tied out for a panther in a deep nullah was killed by a porcupine, several quills having pierced the heart.

I have read of panthers and tigers being attacked and even killed by wild boars. But on page 237, Volume XXI of the Journal, Mr. Fitz-Gibbon records that while a panther was eating a goat a big wild boar came and stood within a yard or two of it, but the panther did not even stop eating and neither animal molested the other. Buffaloes are supposed to be deadly enemies of the great felidæ and ready to attack them at once, but they have been known to graze close to a kill on which a panther was feeding, without taking any notice of it. I tried to recover a wounded panther with the aid of a herd of buffaloes on one occasion. The buffaloes passed through the jungle without taking any notice of the panther which I found dead close to where the herd had passed. Panthers, like tigers, will fight to the death on occasion and the victor will devour the vanquished. Several such instances are on record in the Journal. I have never heard of an encounter between a tiger and a panther but have twice driven a tiger and a panther out of the same cover, where they appeared to be resting in amity.

10. MAN-EATERS.

I have always found a strange fascination in the history of man-eaters. It would make a good subject for a book. The account of the infamous man-eater of Seoni given by Sterndale in his Natural History, and Sanderson's graphic description of the man-eating tigress he disposed of, cannot fail to arouse interest. The annual returns of the number of people killed by wild animals prove that, although these monsters that prey on human beings may not be as common as they were, they still infest many districts in India. An account of the destruction of the man-eating panther which killed the Brinjara boy whose body was found in the fork of a tree, is given in an early number of the Journal. The child was taken in the dead of night when sleeping beside his mother. The animal, which had already killed two human beings, was beaten out and shot by Mr. Davies, Deputy Commissioner of Basim, who mentions that the panther was in milk and had cubs which were not found. He also remarks that the animal was in good condition and had a good coat. Indeed, I have never seen it suggested that man-eating panthers are mangy, a condition popularly ascribed to the tiger, but not borne out by evidence. The only man-eating tiger I have seen, which I shot twenty-one years ago, had a fine, brightly-coloured skin.

Panthers perhaps take more readily to man-eating than tigers. Their habits bring them into closer and more frequent contact with human habitations; careless mothers leave their children where they may fall a prey to the prowler of the night and in wandering round villages it is probable that a panther, even though not a confirmed man-eater, will always be ready to carry off a child if no one is watching. I had to do with a child-stealing panther, soon after the destruction of the one above referred to. This beast had taken up its abode in open country where the only cover to be found was that afforded by the fastnesses of a winding river, with deep and innumerable fissures in its banks, now in the month of May nearly dried up by the heat of the summer sun and the scorching winds that swept across the plain.

The panther used to prowl round the villages at night and pick up sometimes, from the side of their sleeping parents, the children who slept for the sake of the cool night air on the thresholds of the huts. Then it took to attacking adult people in broad daylight. Curiously enough, these people could give no clear account of the monster that assailed them. Some averred that it was black and tailless, a common superstition of the were-wolf kind, prevalent also in Eastern Europe, connecting the man-killing wild animal with the form of a human monster. I thought it probable from the accounts given that this animal was a wolf, but when I encamped at one of the villages, and lay out at night in the shadow of a hut, a small panther approached in the moonlight to stalk me or the goats that were tied up as bait near the head of the bed. I fired and wounded the beast, and it was killed by the inhabitants of a neighbouring village a few days later.

It is a curious circumstance that when I was in Russia two years after this a very similar series of events happened, of which I gave an account in the *Field* at the time. There a mysterious animal appeared and committed depredations, attacking people in broad daylight. The attacks continued over a considerable period, and detachments of Cossacks were sent after the animal but it was never brought to bag. Similar stories of a were-wolf were rife among the superstitious peasantry. The animal may have been a panther escaped from captivity, or a wolf, or possibly a lynx. I was unable to visit the district. There are no panthers in Russia north of the Caucasus, but I have seen tracks of lynxes in the snow in White Russia. These animals do not, however, molest human beings. The only such case I have ever heard of is recorded on page 548, Volume VII of the Journal, where Captain Drake-Brockman relates that in the Mirzapore District three coolies were going along together in single file through the jungle on their way to camp at night. When passing through some high grass, an animal sprang upon the last coolie from behind and fastened itself upon his shoulders. He happened to be walking along at the time with a blanket over his head, and had the presence of mind to turn up the edges and envelop the animal in its folds. The animal fell to the ground, and was smothered with blankets and brought into camp, where it was found to be a Red Lynx. The European lynx is larger than the caracal, and the Russian man-eater may have been one of these animals.

Unarmed natives frequently exhibit remarkable courage in dealing with wild beasts. I read somewhere of a small herd-boy driving a tiger off his cattle dealing the animal a resounding blow on the back with his staff. In a village on the Pein Gunga I was shown the skin of a panther which the inhabitants had assailed with fragments of rock and killed a short time before. In 1894, as recorded by Captain P. Z. Cox in the Journal, a panther was seen to take shelter in a small stack in the open near a village in Kathiawar. A number of Wagher tribesmen turned out armed with sticks and surrounded the stack. After a time the beast broke cover and, seizing a Wagher, bore him to the ground. The others at once attacked the panther with sticks and made it release its hold before serious damage was done. It then turned on another Wagher who stood his ground and closed with the panther, seizing it round the body. The two fell to the ground together. The panther then made for the village, followed by the crowd, when one of the men seized it by the tail, and held on until one of his comrades came up with an axe, and killed it by a blow which spilt open its skull.

In his "Highlands of Central India," Forsyth gives an account of a man-eating panther which devastated the Seoni District and killed nearly a hundred persons before he was shot by a shikari. He never ate the bodies but merely lapped the blood from the throat. His plan was either to steal into a house at night, and strangle some sleeper on his bed, or to climb into the high platforms from which the watchers guard their fields from deer, and drag out his victim. When driven off from an intended victim at one end of a village, he would hurry round to the other side and secure another in the confusion. A few moments completed his deadly work. Forsyth found a curious myth had afterwards grown round the history of his panther. A man and his wife were travelling to their home from a pilgrimage to Benares, when they met a panther on the road. The woman was terrified, but the man said: "Fear not, I possess a charm by which I can transform myself into any shape. I will now become a panther, and remove this obstacle from the road, and on my return you must place this powder in my mouth, when I will recover my proper shape." He then swallowed his own portion of the powder and, assuming the likeness of the panther, persuaded him to leave the path. Returning to the woman, he opened his mouth to receive the transposing charm; but she, terrified by his dreadful appearance and open jaws, dropped it in the mire and it was lost. Then, in despair, he killed the author of his misfortune, and ever afterwards revenged himself on the race whose form he could never resume. This story approximates very closely to the stories of were-wolves prevalent in Eastern Europe.

Of the same nature is the common superstition that the spirit of its first victim accompanies the man-eater to warn it of impending danger, which I have found firmly credited by jungle folk. There is the story of the shikari who sat up over the remains of a man killed by one of these monsters. When the man-eater approached to resume the feast, the arm of the corpse was raised in warning to point to the tree in which the watcher was sitting. The monster looked up and seeing the shikari, at once went away. The man got down from the tree, fastened down the warning hand with a peg, and resumed his vigil in another tree. Again the man-eater approached, but the other hand of the victim pointed out the danger, and he fled once more. No sooner had he gone than the shikari again descended, pegged down the other hand, and climbed another tree. When the man-eater came back there was nothing to warn him of danger; he came up to the kill, and was at once shot by the watcher in the tree.

In 1901 another infamous man-eater appeared in the Seoni District of the Central Provinces, and killed more than twenty people in rapid succession within fifteen miles of one village. This beast was in the habit of entering houses and dragging out its victims. In one instance it took a person from a house in which two children slept undisturbed. It was shot on the corpse of one of its victims, as depicted in a photograph in Volume XIV of the Journal.

On one occasion in a village near my camp when I was out tiger-shooting a sad tragedy had occurred a few days before my arrival. A panther had entered a hut at night and dragged a Gond woman out by the leg. The beast, on being driven off, had rushed into another hut and, seizing an eight-year old boy by the throat, carried him off and devoured him. I sought in vain for any sign or track of this panther. The shikaris said that it was no use looking for the animal as it had left owing to the incantations of the Gonds, to whom my superstitious followers ascribed wonderful power over the great *felidæ*. They said that when a tiger or panther had been doing much damage to the flocks, or to the people in the case of man-eaters, the Gonds sacrifice a bullock to the Tiger-god, and perform various rites and ceremonies to invoke his aid. On the night of the performance of these rites, the god of the Gonds, represented by a White Tiger, stalks about in the vicinity of the village and drives off the beast that has been offending. In this the shikaris, orthodox Hindus, not animists like the Gonds, firmly believed, declaring that the tracks of the White Tiger could be traced on the surrounding jungle paths on the morning after the performance of these ceremonies.

In Volume IX of the Journal, Mr. Inverarity gives an account of a man-eating panther which killed many people in the Nizam's Dominions in 1894. Among the victims was a boy taken from a cot on which he was lying beside a man in the open space in front of a hut. I recollect an instance of a child being taken from between a woman and a dog, over which the panther must have stepped.

Why do animals take to man-eating? The mangy tiger theory refers to old and decrepit animals, or those which have been wounded, and find man an easy prey. This would no doubt account for some cases. Or a herdsman may be killed by accident or in his endeavour to drive a beast of prey from his charge, and a taste for blood so acquired. I recollect a Brinjara being so killed by a tiger which I afterwards shot, but the beast did not become a man-eater, and did not eat any portion of his victim. A commoner theory is perhaps that of the tigress finding man an easy prey for feeding her young and so perhaps bringing up a race of man-eaters. This is plausible and appears to account for some instances, and for the generally-accepted idea that man-eaters are more commonly females; but this idea, judging from the instances recorded, appears to be unfounded. It has been stated that man-eaters are more numerous during or after famines, when they might acquire the taste through scarcity of normal prey, or from feeding on the corpses of people who have perished of want.

11. Methods of Hunting.

Now as regards the method of hunting panthers. In many parts of the country, the only way of bringing these animals to bag is to sit up over a bait such as a live goat or a kill, or over a pool of water frequented by them. There is not much sport in this, but it has to be adopted in default. It certainly has the advantage of giving the keeper of the vigil excellent opportunities of observing the habits of the beast, which, in fact, so far as the approach to and the seizing of the prey are concerned cannot be so well observed in any other way. I have myself little experience of this method. You may sit either in a tree or in a kind of zariba, or in a hole in the ground, covered by a charpoy concealed suitably to the surroundings. On a dark night the latter is the best plan, so that the animal can be seen against the sky-line. I have seldom tried this "sitting-up," and only twice with success. In some districts on dark nights also a lantern may be placed so as to throw a light on the bait. This would be sufficient in all probability to scare a tiger, but a panther is used to wandering about in the vicinity of village lights. When nobler game is to be had one does not trouble about panthers, but they afford very good sport at times, and there is quite sufficient danger in hunting them to class them as very dangerous game.

In many places they may be driven out with a line of beaters, and it is not necessary, as it usually is in the case of tigers, to tie up bait and obtain a kill before finding the game. In country where these animals are fairly numerous and were the terrain is suitable, one can generally decide where they are likely to be found, and carefully arranged beats through likely covers will be successful. It is, however, curious how reluctant the natives sometimes are to give any information. I met a man one morning carrying a dead goat which, he said when questioned, had died, in the night, and had not been killed by any animal. The tell-tale fang-holes in the throat told a different story. The man was with some difficulty induced to show the place where he had found the goat, and it then transpired that he had seen a panther at the kill. Within an hour I had beaten out and shot the animal. In the same district I heard of a panther having killed a pony in a village, but the villagers would only say that the pony had died, and evidently had a superstitious dread of even mentioning the name of panther. I observed that there were no dogs in or about the village, an unusual circumstance. A search in the vicinity revealed the lair of the panther close to the village, but tracks showed that the beast had made off across country on my approach. I followed in the direction indicated by the tracks, and shot the panther on the hillside about two miles off. Not far from the same place a few days later I asked a ploughman at work in a field whether he knew anything of a panther which I had reason to believe inhabited a neighbouring ridge. He professed ignorance until I pointed out the fresh tracks of the animal within ten feet of his plough.

However, when the people get to know one they are communicative enough, and they are pleasant and helpful. After some weeks one becomes known to the countryside, and information is gladly given and assistance offered. For the kind of sport I have indicated the months of February and March and perhaps half April are the best. Towards the end of April the jungle begins to grow more dense, trees put out their leaves, and the beats are more difficult to arrange. In March and April the cover is sparse, and I would recommend the sportsman to keep a special look-out for the evergreen *lokandi* bushes; he will not find a panther in every bush, but if there is one of these animals about it will probably be in the grateful shade of the *lokandi*.

There are less common methods of killing panthers in some parts of the country, as in Mysore where the animal is enclosed with nets and speared when it tries to break out. In Colonel Welsh's *Military Reminiscences* is a very interesting account of the spearing of panthers and tigers on the Bangalore race-course, where they were released from cages, and speared from horseback by Colonel Gillespie and others in the early part of the last century. This was a form of sport at one time indulged in the Hyderabad Contingent, the caged panthers being caught in a trap baited with a goat. A famous sportsman, Colonel Nightingale, died from the rupture of a blood-vessel when in the act of spearing a panther on the Bolarum plain sixty years ago. I have only once taken part in one of these hunts; the panther showed no fight, but crouched in a depression of the ground and was speared without difficulty. These animals have not infrequently been put up and speared by pig-stickers.

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THE MESOPOTAMIAN BULBUL.

By

Claud B. Ticehurst, Capt., R.A.M.C.

On November 20th, 1917, whilst on a short visit to Basra, I found a White-eared Bulbul very common, in fact, as in Sind, it is one of the commonest and most familiar birds. Thinking it was the same as the Indian species I only secured one example. On returning to Karachi I was surprised to find on comparison that the Basra bird was distinctly different. On returning to Basra again this year in March I secured seven more specimens all similar to my original one. So far as I can find out, this Basra Bulbul has never been described or named and I therefore propose to name it.

Pycnonotus leucotis mesopotamia. Subsp. nov.

Diagnosis. Resembles *Pycnonotus leucotis leucotis* but is rather *larger*, with a longer wing and tail, larger and stouter bill and has *dark grey* instead of whitish grey underparts (breast, belly and flanks) and a *yellow* fleshy orbicular margin to the eyelid instead of black.

Measurements.—♂ wing. 90-95, av. 91·6, tail, 90-93, (once 96). av. 91-9 mm.

♀ wing. 87-89, av. 87·75, tail 85-89, av. 87·2.

Total length from tip of bill to tip of tail: ♂ 191-198, ♀ 185-195.

Type locality, Basra, Lower Mesopotamia.

Type specimen No. 149. Basra in coll. C.B. Ticehurst. Nov. 20, 1917.

The type locality of *Pycnonotus** *leucotis*=*Ixos leucotis* of Gould (P. Z. S. 1836) is given as "In India orientali." Hitherto no races of this species have been described, but as *mesopotamia* is obviously a racial form and a very marked one it seems desirable to fix a restricted type locality for typical *leucotis*. This at present I am unable to do, not having access to Gould's paper.

Distribution.—Lower Mesopotamia, Persia (Shustar in the west and Maud in the extreme east of Persian Baluchistan (26° 7′ N 62° 3′E).

How far west this race occurs I do not at present know, but the boundary of Persian and British Baluchistan is probably somewhere near its eastern limit. I have seen typical *leucotis* from Bhani, 132 miles S.S.W. of Kelat in British Baluchistan which is not unexpected, as Bhani is not more than 100 miles from the Sind boundary. One specimen from Charharbar in the Gulf of Oman is puzzling, sexed a female it has a wing of 88mm which corresponds well with *mesopotamia* but it is paler underneath than any of the latter I have ever seen; the colour of the eyelid could not in the dried skin be ascertained.

Hume who, during his trip to Muscat in 1872, went ashore collecting at Korebut, Pasni and Gwader remarked that the White-eared Bubul was common along the Mekran coast as far as Gwader. One cannot say without examining his specimens which race his Mekran birds belong to, but it seems likely that they were *leucotis* or surely he would have remarked upon the yellow eye lid and darker plumage. He gives measurements of one bird "measured at random" as, total length 8″ (=203 mm.), tail from vent 3·5″(=89 mm.), wing 3·7″ (= 94 mm.). This must have been a truly giant *leucotis*, but since no locality for it is given it does not help (it may have even come from India) which only shows one cannot be too careful in points of accuracy. Suffice it to say I have seen no Indian *leucotis* as large as this. Oates in the "Fauna" gives—total length 7·5″ (=190 mm.), tail 3·4″ (=86·5 mm.), wing 3·5″ (=89 mm.), which I should say was fully large for the *average*, which I make to be about 185 for males and 174 for females, with wings about 85 and 81 and tails 82 and 78 respectively. The largest male *leucotis* (wing 88 tail 85) just overlaps the smallest female of *Mesopotamia*. The bill in the latter species sex for sex is noticeably larger on comparison, slightly higher, stouter and longer, and measures from the edge of the feathers 14-15·5mm. as against 13-14·5 in *leucotis*, the smaller measurements being those of females.

The habits and notes of the Mesopotamian bird did not strike me as being different from those of our Indian bird.

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* *Molpastes* was a genus instituted by Hume in 1873 (S.F. i. 378) for the Red-vented Bulbuls without giving the distinctive generic characters. Hume himself put *leucotis* in the genus *Otocompsa* (Cabanis 1851). Oates in the "Fauna" places *leucotis* in the genus *molpastes*, but it seems to me that the distinguishing characters of this genus are too trivial to separate it from the genus *Pycnonotus* of Boie tex Kuhl M. S.) 1826 which is the oldest name.

MISCELLANEOUS NOTES.

No. I.—NOTES ON A YOUNG HOG-BADGER *ARCTONYX* SP. IN THE GARO HILLS.

Wäk-Sel-(Garo). Caught by the Garos near Tura.

He was about 15 days old when brought to me; his little tushes were just beginning to come through. Had been fed on rice and rice water by the Garos. He was in very good condition. He clutches the bowl like a bear, but eats like the pig, with much noise and dirtily. Otherwise his habits are quite clean; he has no smell at all. The fur is a mixture of hair and bristles grey tipped with white, pure white on his ears and round his throat, black legs and stomach. A white tail about 2 inches long now. 12″ from tip of nose to tail. 4″ high. His habits up-to-date are not nocturnal, as he sleeps from 6 to 6 without moving. He sleeps curled up like a hedge hog. In the day time he sleeps with his head between his paws (more like a bear). Most affectionate and cannot bear to be left alone. When startled, he comes towards one growling with his nose in the air (he might try and jump up to rip one). Does not see very well. In a wire cage he tries to dig himself out, or failing that climbs up like a bear. He roots about, but so far I have not discovered anything that he has eaten. Bringing him up on sweet pudding which he loves, gave him a small mutton bone (rawmeat) without any meat on it which he was very keen on. His back teeth are coming through. He has numerous calls, but so far no grunts. When pleased he makes a plaintive little sound, but when he is angry, his calls are discordant. His sense of smell is very good. Colour black and white (no rufous colouring at all).

V. A. JACKSON.

TURA, GARO HILLS, ASSAM, *June* 1918.

FURTHER NOTES ON THE HOG-BADGER.

I have had the Hog-badger about 3 months now. It has grown longer and rather a silvery white, only black hair showing on its head and legs. He stands about 6″ at the shoulder, but is quite 18″ long.

He is very tame, in fact I cannot induce him to leave the house though he is always fed outside. He behaves very much like a puppy dog. Worrying slippers, rugs, hangings, etc., and also stands up by the chair at meal times like a dog.

We had occasion to go to Tura Top, 3½ miles, with an ascent of 3,100 feet. We rode up and I took the boy who usually feeds the badger with me carrying a small basket for ferns. The little fellow walked all the way up except about half a mile when he was so tired that I had to have him carried. He also walked all the way down after the boy. He ate 2 large tins of long earthworms daily and a little bread and milk and pudding. He found several earths and dug out these long earth works (18″ long) and their eggs, ate the contents of the eggs, but not the leathery shells, he also ate some small centipedes and their young—but *no roots*, fruit or vegetables. His sense of smell is remarkable. He is very powerful for his size and very playful—leaping into the air in extraordinary attitudes and pretending to attack one. He can dig himself out of any wire cage with heavy boulders round. He lies on his back and prises them up. He is frightened of snakes, but of nothing else. When a dog comes near him his hair rises up and he arches his back and makes a peculiar sneezing noise. In this way he puts me in mind of my crab eating Mongoose who did the same thing.

V. A. JACKSON.

TURA, GARO HILLS, ASSAM, *12th August* 1918.

[Since we received the above notes we have heard from Mrs. Jackson that the hog-badger is now at large in the jungle.—EDS.

No. II.—PORCUPINE'S MODE OF ATTACK.

With reference to the Miscellaneous Note on page 491 of the Society's Journal, Volume XXV, No. 3, "A fight between a dog and a porcupine," the following may be of interest to your readers:—

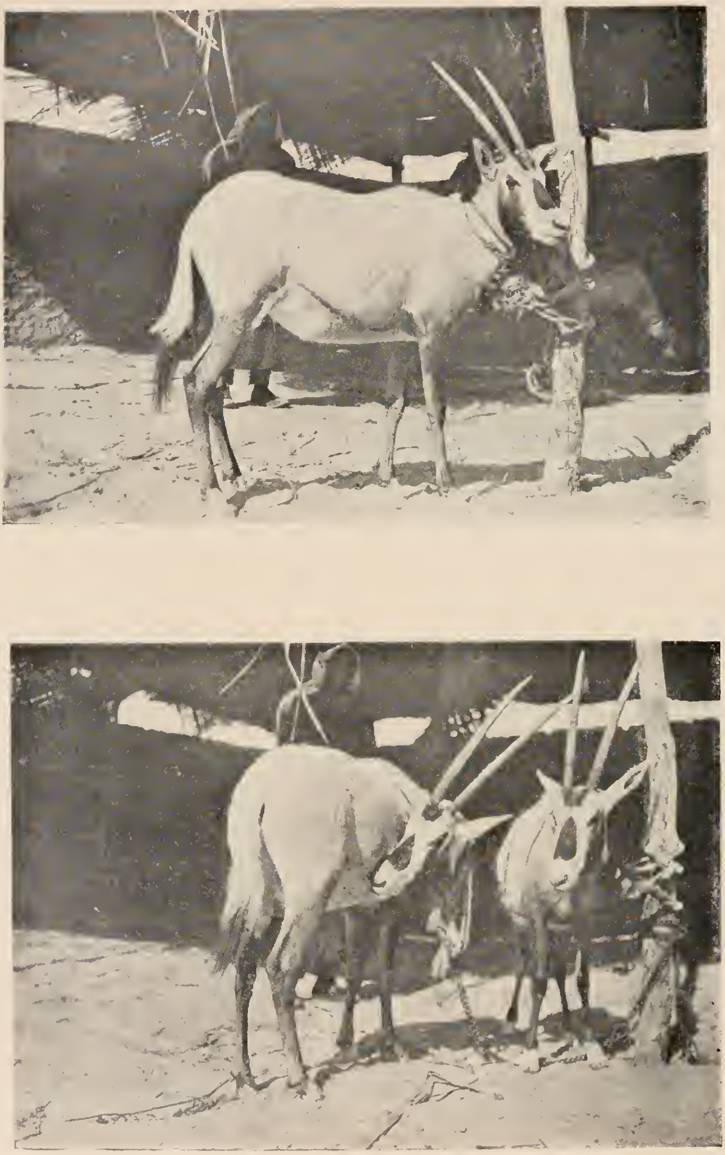
In 1907, I was, stationed at Fatehgarh in the United Provinces and driving home one evening from the Club with my wife we saw in the waning light our dog "Peggy" a bull-terrier, then about two years old, rush after a porcupine that crossed the road in front of us. The porcupine ran for some distance with the dog in full chase over the maidan when the former suddenly stopped and ran backwards into the dog who gave a yelp and commenced rolling on the ground. I at once jumped out of the trap and got hold of her pulling out a quantity of quills from the head and chest, all of which I kept and took back to the bungalow. One quill we noticed was the butt end and this circumstance together with the uneasiness of the dog for the next few days convinced my wife that she still had a quill in her somewhere. There being no Veterinary Officer in Fatehgarh my wife wrote to the young Surgeon attached to the 2/10th Gurkhas then quartered in the Cantonment, asking him to have a look at the dog.. After a long examination he at last located the quill and the next day the dog went up with the small dogboy to the Hospital, and our friend pulled out a half quill of 4⅛″ long which I have now before me as I write. The butt end measures 3¾′ so that together they make a whole quill of 7⅞ inches long. This gives a guide to the diameter which is ¼ inch. The dog, an extremely intelligent beast, seemed to know that the probing was being done for her good, and never moved a muscle the whole time, but licked the Doctor's hand when it was all over. The quill was removed from the flesh over the right shoulder blade, and had been broken off about ¾ of an inch from the surface of the skin.

I may add that I once shot a big male Panther on the Sendra-Ghat some thirty miles from Ajmere and found on skinning him that his two fore feet were full of porcupine quills, pieces from 1 inch to 2½ inches long being embedded in the pads, and some even up the fore arm. The poor beast must have suffered agonies, but I think that it is often so difficult for a Panther and for a Tiger to obtain a meal, that they go for the first animal they come across which may be with dire results to themselves.

A peculiarity of the Porcupine is that his quills drop out a short time after they have been damaged even in the slightest manner. I presume that the time taken for dropping out depends on the damage done. The quill is then replaced by a new one which probably forces the old one out. I have on many occasions picked up these quills and on examining them invariably found the flaw, mostly made I should imagine by projecting rocks, for *Hystrix cristata* is a "cave dweller" although he makes an earth when not in a rocky country.

The natives have the idea that he has the power of throwing quills like darts at his enemies, and probably it is got from finding these old quills lying about.

CHIPSTEAD, SURREY, *June* 1918. REGINALD H. HEATH.



THE ARABIAN ORYX (*ORYX BEATRIX*).

No. III.—METHOD OF PORCUPINE'S ATTACK.

In the last Journal of the Society, p. 491, Vol. XXV, Mr. R. D. Macleod asks for information regarding a porcupine's offensive. Lt.-Colonel F. H. Jackson of the Bombay Political Department, who retired in 1898, told me that his dogs once rounded a porcupine in the jungle. When he came near, the porcupine whipped round and ran backwards at him forcing several quills into his leg. He said the porcupine's action was extraordinarily quick and he thought that on account of the celerity of its movements in this form of attack, Indians had got the idea, which is prevalent, that a porcupine can shoot its quills at an enemy. Colonel Jackson had good cause to remember the occasion. He extracted all the quills he could see in his leg and thought there was nothing left, but a short time afterwards and at intervals for the next six months he would suddenly go lame with intense pain for which he could not account until one day he felt something hard under the skin. He called a doctor who took out a piece of quill which had been in his leg for six months.

E. O. BRIEN, Lt.-Colonel.

Porbandar, *21st April* 1918.

No. IV.—METHOD OF PORCUPINE'S ATTACK.

With reference to Miscellaneous Note No. I on page 491 of Vol. XXV., it may explain to Mr. Macleod what happened, if I tell him of an incident which occurred when a party of us were out pigsticking down the Diamond Harbour Road from Calcutta in 1875. A porcupine was driven out of a patch of grass and made across the open. I rode after it and when almost within spearing distance it suddenly stopped and ran *backward* at the horse with all its spines erect. Of course this was no defence against a spear, but a dog rushing on would have suffered very badly. My first spear did not kill the porcupine as I was rather taken by surprise and he repeated the manœuvre, though wounded, when I caught him up again. The second spear killed him.

F. J. MITCHELL.

Srinagar, *15th May* 1918.

No. V.—THE BEATRIX OR ARABIAN ORYX (*ORYX LEUCORYX*) IN CENTRAL ARABIA.

(With a Plate.)

These two female *Oryx beatrix* were given to me at Riyadh in December 1917, by the Ameer of Central Arabia, Abdul Aziz Bin Saud, and are intended to be presented to His Majesty the King, when an opportunity occurs.

They had been kept as pets in the Palace Gardens at Riyadh for over 6 months and were fairly tame, but it was not an easy matter to bring them to the Coast at Koweit which is some four or five hundred miles from Bin Saud's capital. The first day out from Riyadh we tried leading them separately among the flock of sheep which the Ameer had presented to us. I and a servant rode behind them, but the whole day they made attempts to break away and the boys who held the ropes were thoroughly tired out. Next day, however, we hit upon an expedient which proved absolutely successful. They were tied together with a long rope knotted in the centre which one boy held over his shoulder while another walked close behind shooing them on when necessary. They grew daily more amenable to this method until in about a week's time they stalked along at the head of the sheep. At night they were picketed together near my tent. At dusk they used to begin to dig a pit in the earth or sand about a foot deep and therein settled themselves for the night. This is probably their natural and instinctive habit. They would be invisible at even a short distance, their horns being indistinguishable from branches of dried desert bushes. Both are females. The smaller is called Nural and the larger Al Maghrura. They are particularly fond of lucerne and dates though Bhoosa hay should be the staple fodder. They come, I understand from the Great Nefudh south-west of Nejd and are now somewhat rare as it is not difficult to stalk them among the sand dunes. They are said never to drink in the wild state, but these two are accustomed to a drink every day or two. One curious superstition the Arabs hold about them is that eating their flesh will expel a bullet which has lodged in a man's body even if it has been embedded for years. The Arabic name is Wothaihi or Wild Ox. They are possibly the *reem* of the scriptures. People have wondered whether these Oryx were originally brought over from Africa by man but any one who knows the E. African Oryx will perceive greater differences than are likely to have been evolved within the known historic periods. As for their habitat I expect they roam the whole Nefudh or sand deserts of Arabia. Sir Percy Cox informed me that he had come across their tracks in the country behind Muscat.

R. E. A. HAMILTON, LT.-COL.

BOMBAY, *June* 1918.

No. VI.—NOTE ON A TAKIN HEAD FROM ASSAM.

Last month, while engaged in some operations in the hills between this district and Burma, I found the horns and frontal bones of a Takin in a Kuki village. The inhabitants having evacuated the village before our arrival, I was unable to obtain any first-hand information as to where the animal was killed. The village was situated East of the Tuzu Ruei about longitude 94° 50′ and between latitude 25° 50′ and 25° 30′.

For the following reasons I think it is virtually certain that the animal was killed somewhere not far from where the head was found : (1) The condition of the particles of flesh adhering to the bones indicated that the animal had been killed this cold weather. (2) Political conditions make it impossible that the horns could have been brought by traders either directly or indirectly from the Mishmi country or any country where Takin are known to exist, and in any case a pair of Takin horns is not an article of trade. (3) A Kuki who knew the country on seeing the horns said that such an animal, though very rare, did exist on the high mountains between there and Burma, meaning the system running roughly S. W. from Saramatti. (4) A Lhota Naga who was with me at the time said they were the horns of an animal called ' michi, ' which no Lhota at present alive had ever seen, but which tradition said lived on very high mountains. He gave me the traditional description of the animal, which tallied exactly with that of the Takin. The Lhotas can only have known of this animal by having met with it on their migrations. In this respect the evidence is strongly against them having come from anywhere N. or N -E. of Saramatti. On the whole the evidence appears to me strongly to indicate that this head was not brought from any known haunt of the Takin, but indicates a new habitat of the animal. Perhaps some readers from the Assam frontier of Burma could produce further evidence on the matter ?

J. P. MILLS, I.C.S.

MOKOKCHUNG, NAGA HILLS,
25th May 1918.

No. VII.—PANIC IN ELEPHANTS DURING AN EARTHQUAKE.

A severe shock of earthquake took place at 4-15, and lasted 3 minutes on the 9th July. The Government elephants were feeding in front of the Court-house at Tura. A very large mukna, a large female and a butcha tusker. As soon as the first and most severe shock took place, the elephants ran up the hill, towards the D. C.'s house, which is on a ridge overlooking a very deep valley. The distance from the Court-house to the gate of the D. C.'s house is about 500 yards. The large mukna was first, reached the gate and tore it from its hinges and came straight up the road with the small elephant holding on to *his tail.* The mahout had no control over him, and the other two elephants had no one on their backs. (My husband and I were standing outside watching the plaster coming down in the bungalow and the stone walls in the garden giving way). As soon as the elephant broke the gate, the Garos advised us to go in, as the "hatis" would pass us, and might attack us in their fright. Just as we got into the verandah, the big mukna reached the front of the house. He never stopped but rushed along breaking down the 2nd gate—still with the butcha holding his tail. The female stopped in front of the porch, and proceeded to knock large lumps of turf from my lawn, making queer noises and striking her trunk, also trembling violently. The mahout clung to the trunk and quieted her down gradually. The other animals rushed up a very steep hill into the jungle and were only turned back by men with spears and sticks. If the little hati had not clung to the tail, the 'mate' on the back would have been thrown off, as the mukna is a most surly animal. Their instinct was to run *up a hill* into the jungle, and not along the big flat cart road. As I mentioned, the D.C.'s house is on a ridge with two roads leading to it. One, with the gate is more or less a carriage road, the other skirts the garden below and is used as a public road, the elephants always use this lower road on their way to grass and water, it runs along the side of the hill, and it received part of the stone wall from the garden, or large boulders, shaken down by the shock. The "hatis" seemed to realize that it might have given way and kept on the top of the hill, breaking down the gates guarding the top road, in preference to going on the open khud road.

The Garos say, butchas always catch the tails of larger elephants, when in a panic. These hills are full of elephants, they do much damage and Garos are more frightened of them than tigers or bears.

Tura, 10*th July* 1918. V. A. JACKSON, F.R.G.S.

No. VIII.—ON WHITE ELEPHANTS.

Considerable interest was shown in Bombay at the statement in a recent Burmese letter of the *Times of India* that a white calf had been born to one of the Bombay-Burmah Elephants and it may be of interest to your readers to record what actually happened.

A female calf born on 6th March 1918 aroused a good deal of excitement by its unusually light colour and in view of the importance attached by the Burmese to the birth of a genuine SINPYUDAW it was thought advisable to submit the claims of the calf to a jury of prominent Burmans on the 7th April.

The points of a SINPYUDAW appear to be as follows :—

1. Twenty Toes.
2. Pearl eyes.
3. Tail "Tah Gah Paik."
4. Red mouth.
5. Light coloured and smooth skin.

The calf though possessing a rather light skin at birth and pearl eyes failed to fulfil these conditions, having only eighteen toes and a tail that was not up to the requirements. It was therefore at once pronounced to be not a genuine SINPYUDAW.

The colour has since grown perceptibly darker and on reaching maturity is not likely to differ in any way from the ordinary.

The fact that the "whiteness" of an elephant depends as much on the possession of certain points as on its colour may be of interest to your readers, as most people appear to believe in the existence of a milk white animal.

While on the subject of elephants it may be worth correcting a misprint in our Journal, XXV., p. 475, where there is a reference to a "fine onmusth (tuskless male)." The Burmese words are—

HINE=tuskless male.
TAI=single tusked male.

I have no doubt that the writer originally wrote HINE which was altered to 'fine' through a misapprehension. I have seen a similar mistake before.

Bombay, *May* 1918. H. MACNAGHTEN.

No. IX.—THE WHITE-CHEEKED BULBUL (*MOLPASTES LEUCOGENYS*).

I found a pair of these birds nesting, and when I thought the nest was complete, I visited it on several occasions, to get the eggs. I was not however successful and came to the conclusion that the bird had deserted. Quite ten days later or possibly more, I had another look and to my surprise found two eggs. This was on a Tuesday. I left them till Friday, when there were three. I took the clutch. On proceeding to blow them, I found the first difficult and in the end it burst, just as bad eggs are apt to do. On examining it the yolk was intact and right down at the small end, more or less adhering to the shell. I put the other two eggs into water to test them. To my surprise, instead of sinking as fresh eggs do they floated!! I blew them all right and the yolks showed absolutely no signs of incubation, but they gave me the impression that they were "muzzy," like eggs become which have been kept sometime. I have had many years experience in birds' nesting, but I have never before come across fresh eggs, as these must have been, floating. A fresh egg, even though unimpregnated sinks.

As the nest in this instance remained untenanted for so long a period, can it be possible that the Bulbul laid new eggs elsewhere, without sitting, and then carried them to it?

R. M. BETHAM, Brig.-General.

Flag Staff House, Lansdowne, U. P.
15th June 1918.

No. X.—THE PLUMAGE OF THE PURPLE HONEYSUCKER (*ARACHNECTHRA ASIATICA*).

In Vol. XVII, No. 2, p. 540, I have come across a query by Mr. D. Dewar on the plumage of the male Purple Honeysucker (*Arachnecthra asiatica*).

He apparently was surprised to find that Jerdon in his "Birds of India," Vol. i, p. 370 (correctly) described the winter plumage and calls in Oates in the "Fauna" to bear him witness that the purple plumage of the breeding season is never lost when once assumed. He is however somewhat unsettled in his mind on the subject by Mr. F. Finn (Birds of Calcutta. p. 63) who sided with Jerdon's view and finally asks members of the Society for further information. As no one has apparently done so, I may as well give my experiences which will, I think, settle the question. Here in Karachi this species is very abundant in winter and from October onwards I never saw a single bird in metallic dress until January 26th when I saw one (out of dozens) apparently in full plumage, and on the 27th I shot one (and later saw many others) in change moulting body, wings and tail and thus assuming the metallic plumage. I have moreover seen specimens of the moulting from the metallic dress to the yellow breasted winter plumage. I have not yet seen a large enough series of winter birds to say for certain, but it is not unlikely that the adult male in winter can be differentiated from the young male by the more glossy wings and tail.

CLAUD B. TICEHURST, Capt., R.A.M.C.

Karachi, *July* 14*th*, 1918.

No. XI.—NOTE ON THE INDIAN LONG-BILLED VULTURE (*GYPS INDICUS*).

Since according to Blanford this bird breeds in colonies on precipitous cliffs, the following note may be of interest:—

On February 4th while out in camp I came across an enormous pipal tree which had five large nests in it, which I presumed to belong to *Pseudogyps bengalensis*. However, on closed examination, I noticed *Gyps indicus* sitting on one of the nests, its thin lead-coloured neck being easily distinguished. On my climbing the tree, the birds sat closely, enabling me to discover that no less than three of the nests belonged to *G. indicus*, the other two being occupied by *P. bengalensis*. One nest of the former contained a fresh egg, pure white and measuring 3·55×2·75 inches. The other four nests had well-grown young ones. *Gyps indicus* showed much more anxiety to return to their nests than *P. bengalensis*, and several times came and settled only a few yards from me when I was inspecting the nests, which appeared to differ in no way from those of *P. bengalensis*. This is the first time I have seen *G. indicus* in the Lucknow district. In Muttra and Agra districts the bird is quite common and comprises about a quarter of the assembly at a carcase. I did not find it breeding there, although it is certain it must do so.

U. S. Club, Lucknow, W. H. MATHEWS, I.P.
9th May 1918.

No. XII.—THE COMMON HAWK-CUCKOO (*HIEROCOCCYX VARIUS*) IN THE PUNJAB.

It is stated in the Fauna of British India, Birds, Vol. III., p. 214, that the Common Hawk-Cuckoo or true Brain-Fever Bird *Hierococcyx varius* (Vahl.) is not found in the Punjab. I have already shewn elsewhere that this statement must be modified as the species is (in some years at any rate) a common summer visitor to the district of Ambala, and in smaller numbers to the neighbouring district of Ludhiana. I have now to record a further extension of its range to Lahore where I heard one calling in a garden in Egerton Road on 21st April, and again in the Lawrence Gardens on April 24th. On both occasions the "brain-fever" call was heard.

HUGH WHISTLER, F.Z.S.,
Indian Police.

Jhang, 20*th May* 1918.

No. XIII.—THE BREEDING HABITS OF MRS. HUME'S PHEASANT.

I have been reading through Vol. XXV, No. 3, and I am sending you as few particulars which you may find interesting.

While I was in the Chin Hills, I shot quite a number of Mrs. Hume's Pheasant and I skinned two very fine cock birds which I intended sending you, but as you know, I was very suddenly ordered on service, and the skins are still at my bungalow at Dehra Dun.

1. The Durwan of the Dak Bungalow at Tiddim found a nest and a clutch of 6 eggs of Mrs. Hume's and Mr. Wickham (of the P. W. D., Burma) was then staying at Tiddim. He took half the clutch and gave me the other three eggs. The eggs were found at the foot of a tree of a dwarf oak covered spur and the nest was hidden in a small bush (about 1′ high) of undergrowth. The nest was a simple excavation of the ground lined with oak leaves. We did not see the birds but the Durwan did. I think the clutch was taken on the 25th March 1916, but I have not my diary with me, though Mr. Wickham would know. The nest was situated on well drained ground on the top of a spur.

I had a sitting hen and placed the three eggs under her. As far as I remember, they took 26 days to hatch, but I only got one chick as the hen crushed the others. The young bird was as wild as anything imaginable. When I went into the hen house to see if any eggs had hatched, this chick jumped out of the nest, on to the ground and ran at a great pace and hid behind a stone as it could not escape. I then placed a very thin meshed basket over the hen and her chick on my lawn as the chick did all it could to escape into the jungle and its foster mother could do nothing with it. There was no doubt from its markings on the wings and body that it was a Mrs. Hume chick. It would only drink dew on the grass in the early mornings. Whenever it saw a human being it used to run and hide under a tuft of grass or underneath its foster mother and I had the greatest difficulty with it when I let it out. On one occasion, it bolted 100 yards towards the jungle at a terrific pace and it took all my servants over an hour to find it. Its pace was phenomenal and it could hide very easily under the smallest tuft of grass. The foster mother could not understand her fractious offspring and got very fed up with it as it would not stay with her. On the 17th day after hatching, I was putting the little beast back into its cage where the mother was, after it had escaped through the meshes and had been found 200 yards from my bungalow when I had given the little beast up as lost. The mother pecked her offspring on the head and killed it. I was very sorry, as I had high hopes of rearing it after keeping it so long. I used to feed it on boiled rice and little pieces of cooked meat which the Chins said I must give it. Mr. Wickham was able to blow his eggs successfully as they were quite fresh. There was a fine flock of about 12 birds always living in the open forest and stunted jungle about 500 yards east of the Gurkha Basti 2½ miles from Tiddim and below the Tiddim-Fort White Road. I had several good mornings here with my dogs, as each year there were 4 woodcock living close by and also a good many bamboo partridge. But the only place, at which I found Mrs. Hume at all numerous was on the grassy slopes of the hill 2 miles N. and opposite to the Dak Bungalow at Fort White. I used to go here after Barking Deer and Gural and shot quite a number of Mrs. Hume and flushed fairly large numbers at times. I used to see them running away through the grass and they are at once recognised by the clucking sound they make as they run away, which is their alarm cry.

I always found them either in stunted jungle on or grassy slopes with a few oakes, pines or rhododendrons scattered about.

Occasionally I have seen them in very heavy jungle where one gets Tragopan (scarlet breasted) but open jungle or grassy slopes were more or less near by. The height at which I met them was generally between 5,000 to 7,000 feet.

I have seen others below the road East of where No. 4 Stockade used to be (4,000 ft.). This appears to be the place where Finn shot his specimen.

R. BLANDY, CAPTAIN.

HEAD-QUARTERS 7TH INFY. BRIGADE, M. E. F.
MESOPOTAMIA, 25*th March* 1918.

No. XIV.—NOTE ON KALIJ PHEASANTS IN THE CHIN HILLS.

Round No. 3 Stockade Bungalow there is a lot of stunted jungle in which there are quite a large number of Kalij pheasants. I shot and skinned a large number of these pheasants but I hardly ever shot 2 alike here. They were all hybrids between Williams and Horsfields pheasants. I shot pure *horsfieldi* up in the hills and pure *williamsi* pheasants on the Western slopes in the Valley of the Manipur R. and also at Kalewa and Yazajee. I never shot a pure William's pheasant on the Eastern Slopes of the Chin Hills and they were all *horsfieldi* or hybrids ; so it appears that Williams pheasants keeps to very definite localities and is probably, I believe, only found in the valley of the Manipur R. at present, as far as the Chin Hills is concerned.

HEAD-QUARTERS, 7TH INFY. BRIGADE, R. BLANDY, CAPT.
M. E. F.

25*th March* 1918.

No. XV.—OCCURRENCE OF THE LESSER FLORICAN OR LIKH *S. AURITA* IN THE MAHABLESHWAR HILLS.

The Florican I wrote to you about was shot on the hills in the month of April 1915. The actual locality was wooded plateau 6½ miles from Mahableshwar, about half a mile through small jungle to the south of the Mahableshwar-Panchgani Road. There was a pool of water on the plateau. We walked about for sometime looking for its mate but with no success. Mr. J. W. Fellowes, Mrs. Fellowes and Mr. J. T. Tanner, were all there and could verify this statement, if necessary.

KYRLE FELLOWES.

MAHABLESHWAR, 10*th May* 1918.

No. XVI.—ABNORMAL VARIETIES OF THE INDIAN RED-START *(R. RUFIVENTRIS)* AND THE COMMON HOUSE CROW (*C. SPLENDENS*).

An account of these abnormal varieties of common birds may be of interest to place on record—

(1). The Indian Redstart—*Ruticilla rufiventris.*

Female, shot near Mochiwala, District Jhang, Punjab, on 14th March 1918.

This bird differs from a normal female only as regards the wings and tail.

In the tail one of the central pair of feathers (the other is missing), which is greatly abraded and worn, is brownish grey on the inner web instead of blackish brown.

The wings differ in that the greater coverts are uniform greyish brown with paler edges, while the primaries, secondaries and tertiaries are dirty greyish white, slightly darker on the outer webs; all these feathers have the basal halves of their shafts dark brown.

(2). The Common House Crow—*Corvus splendens.*

During June and July 1917 at Ludhiana, Punjab, I noted a Crow about, always frequenting the same locality, with a large white patch in the centre of each wing; both wings were alike, and the white patch was apparently formed by the basal halves of the later primaries and earlier secondaries.

All other parts of the bird were apparently normal.

(3). The Common House Crow—*Corvus splendens.*

Female, shot at Jhang-Maghiana, Punjab, on 5th May 1918.

The description of this bird is as follows:

Nasal tufts, forehead and anterior half of the crown, cheeks, chin, and throat, (*i.e.*, the usual mask) dull chocolate brown.

Hind neck, mantle and breast rich creamy white, tinged with brown on the earcoverts and sides of the head, and shading into the creamy brown of the abdomen; thighs and lower tail coverts slightly darker than the abdomen. Scapulars, lower back and rump dull chocolate brown with occasional darker feathers, which are new feathers.

The wings with their coverts are clear creamy brown, edged with white irregularly in a greater or less degree on all feathers, giving the extended wing a somewhat patchy appearance. There is most white on the secondaries and greater wing coverts and least on the innermost lesser coverts. The wing when closed has in general a rich creamy whitish brown appearance. Both wings agree in their markings.

The tail is a clear creamy brown with broad white edges, the outer webs of the central pair being entirely white. The outermost feather on the right side is a darker brown than the others with no white edge. Although not freshly moulted it appears to be more recent in growth than the others.

Iris dark brown; bill and legs dusky brown. Ovary minute. The traces of moult on the upper parts as described above shew a tendency in the plumage to moult out darker, unless the difference is due to excessive fading of the old plumage.

This bird was observed for some months during which period it kept very closely to the same locality; in the same locality there was a second specimen of similar appearance, and both probably were hatched in the same nest. The other crows with which they were consorting showed no objection to their abnormal colour.

HUGH WHISTLER, F.Z.S.,
Indian Police.

JHANG, 20*th May* 1918.

No. XVII.—THE COLOUR OF THE EYE OF THE FEMALE WHITE-EYED POCHARD *NYROCA AFRICANA.*

I have lately had need to look up some of the old "Journals" and in Vol. XVI, 2, frontispiece, I notice a plate of the White-eyed Pochard from Mr. Stuart-Baker's series of "Indian Ducks and their Allies" and here the female is represented as having the irides *white* as in the male. Surely this is not correct? I have examined a fair number of females and have invariably found the irides to be *brown,* as late as April at all events. The "Fauna" is silent on the subject and I have no other works by me now. Perhaps other members will record their experiences?

CLAUD B. TICEHURST, Capt., R.A.M.C.

Karachi, *July 14th,* 1918.

No. XVIII.—NOTE ON THE HABITS OF THE MALLARD *ANAS BOSCHAS.*

During all February and the first week in March 1918, I observed last flocks of Mallard, settling close in shore on the sea. The birds came every day morning and evening going away in an easterly direction during the middle of the day. During this time there had been very little rain and this may have led to an insufficiency of feeding in the few jhils round here. The sea here is very shallow for a long distance out, which may account for the duck settling, but I have never observed this habit before, and I should be interested to hear if it is a common occurrence.

Though work was going on, loading and unloading ships close to the point where the birds settled, this did not seem to disturb them. They were however very wary and it was not possible to get near them with a gun, and I never succeeded in shooting them. Through a glass it was quite possible to distinguish fully the plumage of the birds and they were frequently to be seen disporting themselves on the sands much like the ordinary farmyard duck.

Bandar Abbas, 17*th March* 1918. E. J. D. COLVIN, Lt.-Col.

No. XIX.—AN ADDITION TO THE GAME BIRDS OF BURMA. THE LONG-BILLED HILL PARTRIDGE (*RHIZOTHERA LONGIROSTRIS,* Temm.) IN TENASSERIM.

The addition of this fine partridge to our avifauna is due to the energy of Mr. J. C. Hopwood of the Imperial Forest Service. He most kindly sent me the skin of a female which neither he nor Mr. Mackenzie of the same service could identify. I was unable to do so either and forwarded the skin to Dr. Annandale, Director of the Zoological Survey. He wrote that they had not got it in the Indian Museum and advised me to send it to Mr. H. C. Robinson, Director of Museums, Federated Malay States, as it probably was a Malayan species. I did this and Mr. Robinson kindly identified it and sent me the following interesting note: "The Partridge sent is a specimen (female) of *Rhizothera longirostris* (Temm.), the Long-billed Hill Partridge. It does not appear to have been recorded from the Indian Empire, but is common over the whole of the Malay Peninsula in suitable localities and also in Borneo and Sumatra in slightly modified forms.

In the Malay Peninsula it is an inhabitant of heavy jungle, usually dry jungle in which there is much bamboo up to about 4,000 feet. It is very terrestrial and partially crepuscular in its habitats. Its note is a loud clear whistle often heard at night."

Mr. Hopwood sent me the following note along with the skin:—"The bird was shot by my assistant about 15 miles inland from Bokpyin in bamboo jungle, about half way between Mergui and Victoria Point. From the rudimentary spur it is probably a female. The birds are reported to be rare." On the label is the following information:—

"Locality: about 120 miles south of Mergui in bamboo forest.

Date 7th March 1918, shot by Mr. W. R. French and skin given to J. C. Hopwood.

Bill black, legs flesh colour, claws horny."

The catalogue of the Game Birds in the collection of the British Museum gives the following:

RHIZOTHERA.

Rhizothera (Gray).—"*List. Gen. B*, 2nd ed., p. 79 (1841). Type.
id. Gen. B. iii, p. 505 (1846) .. .. *R. longirostris.*

Tail with 12 feathers, rather more than half the length of the wing.

1st primary equal to the 10th, 6th slightly the longest. Tarsi longer than middle toe and claw, and provided in both sexes with a pair of short stout spurs. Claws, moderate and slightly curved.

Range.—Southern part of the Malay Peninsula, Sumatra and Borneo."

There are only two known species, the other Hose's Long-billed Francolin (*Rhizothera dulitensis*, Ogilvie-Grant) having been got at Mount Dulit in Borneo.

Ogilvie-Grant in his Hand-book to the Game Birds, Vol. I., gives the following concise description of the bird:—

"*Adult male.*—Top of the head rich brown; general colour above chestnut, blotched with black, shading into grey, mixed with buff on the lower back and upper tail coverts; sides of head and throat reddish chestnut; neck, chest, and upper mantle *grey*; rest of underparts rufous buff. Total length 14·6 inches; wing 7·7; tail 3·5; tarsus 2·2.

Adult female.—Differs from the males in having the neck and chest *rufous-chestnut*, and the lower back and upper tail coverts *mostly buff*. Slightly smaller than the male."

Finn in his Game Birds of India and Asia says:

"This peculiar Partridge, which ranges from the south of the Malay Peninsula to Borneo, is at once recognisable by its large bill, which is big enough for a peacock, though the bird is of the ordinary partridge size about fourteen inches long."

Great credit is due to Mr. Hopwood for adding this species, as Davison with a good staff had collected in Tennasserim for over four years. Bingham and others also collected there without discovering it and game birds however rare they may be, are not as a rule absolutely passed over.

I hope Mr. Hopwood will be able to get further specimens and give us more information about this interesting bird.

CHAS. M. INGLIS, M.B.O.U

BAGHOWNIE FTY.,
DARBHANG DIST., 31*st August* 1918.

No. XX.—NATURAL HISTORY NOTES FROM FAO

BY

W. D. CUMMING.

(Corrections to the List of Birds from Fao published in the "Ibis," 1886 and 1891.)

The Persian Hooded Crow—*Corvus capellanus*. In the winter, birds are often seen with the white parts strongly tinged with grey, this might be seasonal or a sign of birds of the year.

The Grey-backed Warbler—*Ædon familiaris*. Plentiful, breeding everywhere on both sides of river. This is a beautiful whistler during the breeding season.

Upcher's Warbler—*Hypolais languida.* Plentiful, breeding everywhere on both sides of river. The note against *Scotocerca inquieta*, the Streaked Scrub-Warbler refers rightly to this bird.

The Streaked Scrub-Warbler—*Scotocerca inquieta.* This bird is *not* to be found at Fao, as might be expected, the situation is unsuited to its habits. This was an unfortunate error, which crept into my notes by mistake.

Finsch's Grey Shrike—*Lanius fallax.* I believe this was wrongly identified and was corrected later to *L. assimilis ?* by Dr. Bowdler Sharpe.

The Common Starling—*Sturnus vulgaris.* Starlings are to be seen in flights in the neighbourhood of Fao during the winter months November to February, some years more plentiful than at others. All that I shot were identified as *S. vulgaris*, but might turn out to be *S. vulgaris caucasicus.*

Rose-coloured Starling—*Pastor roseus.* Only noticed in brown plumage.

Cumming's Red-rumped Wheatear—*S. cummingi.* I believe I identified this as *S. chrysopygia*, but Dr. Bowdler Sharpe found it to be a new species and named it after me.

This is the only specimen obtained by me, whether the red-tailed chats seen, occasionally in the neighbourhood of Fao belong to this or to *S. chrysopygia* I cannot say.

Dr. Bowdler Sharpe asked me to collect chats for him and I sent him several skins of different species and it was from among these he identified the present bird. He unfortunately forgot to send me a description of the bird or an illustration of it, and my note given against this does not rightly apply to it.

Syrian Blackbird—*Turdus merula syriacus.* This was the only one seen or secured by me.

Spanish Sparrow—*Passer hispaniolensis.* To be found at Fao—not very plentifully—associating with the Common Sparrow *P. domesticus* in winter and early spring.

Red-headed Bunting—*Emberiza luteola.* The only bird seen or secured by me.

Lesser Short-toed Lark—*Calandrella minor.* The two mentioned were identified by Dr. Bowdler Sharpe. See notes in the Ibis, 1891.

The Short-toed Lark—*Calandrella brachydactyla.* Also identified by Dr. Bowdler Sharpe. See Ibis, 1891.

The Pale-brown Swift—*Cypselus murinus.* Identified by Dr. Bowdler Sharpe as *Cyprellus pallidus* (Ibis, January 1891). Only one nest found containing eggs and taken by my collector.

Indian Roller—*Coracias garrula.* This is not infrequently seen above Fao on both sides of river, and breeds in holes in the date palms, or other trees. One young one was brought to me from Dora, about 15 miles above Fao, which I reared on young frogs and small fish, with a little raw meat occasionally, it fully matured and became quite tame flying about the station and coming regularly for its meals.

Common Indian Bee-eater—*Merops viridis.* Only once seen at Fao, after a severe storm, no specimens secured.

Barn Owl—*Strix flammea.* These birds bred in the loft in the old telegraph wooden buildings. Fairly plentiful during spring and summer in suitable localities.

Little Brown Dove—*S. cambayensis.* This is the only specimen secured during a severe storm; shot by my collector. This seems a good deal out of the way to come across this bird, and I have often wondered whether it might not have been a caged bird got loose.

The Seesee—*Ammoperdix bonhami*. Not to be found in Fao or neighbourhood. The country is unsuited for it.

Wood Pigeon—*Palumbus palumbus*. One year a large flight of these birds visited Fao, and many built nests in the date groves, but I never heard of any young being found. They left very suddenly.

Collared Pratincole—*Glareola pratincola*. Breeding in neighbourhood of Fao.

Lapwing—*Vanellus cristatus*. To be obtained at Fao some years.

White-tailed Lapwing—*Chettusia leucura*. To be found at Fao occasionally. I have shot specimens.

Kentish Plover—*Æ. alexandrina*. Besides this species I have found others breeding, but was not able to make sure of their identity.

Whiskered Tern—*Hydrochelidon hybrida*. Shot at Fao. See notes in Ibis, January 1891.

Little Tern—*Sterna minuta*. I obtained a series of small Terns, intermediate between minuta and saundersii which I personally handed to Dr. Bowdler Sharpe.

Imperial or Black-bellied Sand-Grouse—*Pterocles arenarius*. Eggs of this species have been obtained from the interior of Persia and Arabia and brought to Fao.

Large Pin-tailed Sand-Grouse—*Pteroclurus alchata*. These are brought alive from Persia, I have had several brought from neighbourhood of Bandermashoor, where they are reported to breed.

The Common Sand-Grouse—*P. exustus*. At times Grouse are seen and heard flying over Fao, which with the aid of binoculars I thought might be this bird but never obtained a specimen.

Macqueen's Bustard or Houbara—*Houbara macqueeni*. These are to be had on both sides of the river during winter. The eggs I received were sent to me by the Sheikh of Koweit the late Sheikh Jerrah.

Mr. McDonall, British Consul at Mahomerah, wrote to me on one occasion as follows: "An Arab friend of mine tells me that Houbara breed in the Ram Hurmuz district, he says when he lived in Fellahieh he on several occasions had Obara chicks brought in. He also says a much larger bird of that kind is rarely seen in that neighbourhood. Could this be the Great Bustard."

I once shot a smaller Bustard, in Bushire, the *macqueeni*, it came into the compound of the house I was living in. Again on a second occasion I shot a similar bird off the mouth of Shat-el-Arab, while the steamer I was on was aground on the Fao bank. The bird kept flying round the steamer, during a heavy rain storm, when the land was obscured.

In the first instance I made a specimen of the bird and sent it to my brother Mr. John Cumming in Karachi, and I believe he sent it to England, but that it got lost in transit.

In the second instance the pot claimed the victim! So that I have never been able to confirm my identification, and I have never heard of any others being secured about these localities.

This much is certain that both birds were a good deal smaller than *macqueeni*.

Stone-Curlew—*Œdinnemus scolopax*. Not uncommon on both sides of river in the desert tracts at back of date-palms.

White Ibis—*Ibis melanoacephala*. Plentiful at Fao during winter.

White Stork—*Ciconia alba*. Does *not* breed at Fao, the eggs were obtained from Baghdad.

Little Bittern—*Ardetta minuta*. I obtained two young nestlings on one occasion from the Persian side of the river.

MAMMALIA.

I once obtained a long-eared bat covered as far as I can recollect now with hoary white hairs, which I sent to the British Museum and which was considered interesting, unfortunately I have misplaced the letter from the British Museum giving the identification. It may be in the Quetta Museum.

REPTILIA AND BATRACHIA.

Trionyx euphraticus and *Clemmys caspica*. Not uncommon in the river off Fao.

Uromastrix microlepis. I think there is some mistake in stating this Lizard is to be obtained at Fao. They usually inhabit sandy tracts while the soil of Fao is loamy and subject to inundations.

Varanus griseus. Not uncommon about Fao.

Rana esculenta. The edible frog. Plentiful at Fao.

Hyla arborea. Plentiful at Fao.

W. D. CUMMING.

KARACHI, *March* 1918.

No. XXI.—HOW TROUT WERE INTRODUCED INTO KASHMIR.

When I left Kashmir in May 1890, I was retiring from India where fishing had not been of special interest to me, but in the years that followed many of my happiest days were spent among keen fly fishers in "Bonnie Scotland" whose lochs and streams are full of the "spotted beauties," so that when fate sent me back nine years later (May 1899) my first thought for holidays was of fishing. Work tied me to Srinagar and I was told the nearest stream where sport could be had was the Arrah river which then flowed through the reservoir at Harwan. The stream and surroundings I found to be ideal but the fish were spawning at the time when one expected to find them most sporting and were very disappointing in appearance. I felt that if they could be replaced by the beauties I had loved at home, here was indeed a true angler's paradise.

To think in those days was to act and the merry month of May in which I arrived was not out before my brother William (now Lt.-Col. Mitchell, V.D.) in conjunction with Col. Ward, Col. Unwin and Capt. Allan had promised £50 towards the scheme which my experience in Scotland had taught me was feasible. Early in June, Capt. Goodenough, a fellow passenger on my journey out, introduced me to Major (now Colonel) Godfrey, First Assistant Resident, who told me that the Duke of Bedford who had been presented by the Durbar with some Kashmir stags was anxious to do something in return and had offered to send out trout ova if some one could be found to carry on the work necessary to establish the fish in Kashmir. We soon fixed up preliminaries as I wanted nothing better than to do that work and thence forward much of my spare time was taken up with investigations and a certain amount of fishing, chiefly with the Mulberry as a bait. Khont Cheroo (*Schizothorax esocinus*), Chush (*S. intermedius*), Khōnt (*Orenius sinuatus*), Anyur (*Exostomastoliczikne*) and even the little Tilgrun (loach-*Nimachilus marmorata*) all take this bait in Kashmir, but quite 9 out of every 10 fish caught at Harwan were *Oreinus* in these days. They were very plentiful and I can remember one day, sitting with Capt. Allan—he at the head and I at the tail of one pool—taking out over 100 in 1½ hours of an average weight of about half a pound. It was here that I gave my faithful henchman Sodahma Pundit, his first lesson in stripping fish and fertilizing the ova. He was openly incredulous of the result when I told him to put them (the *Oreinus* fertilized ova) into a hatching box and it was evidently with a new respect that he came some days later to tell me they had all hatched out. Insect life had to be studied in the smaller streamlets and though some doubtful assets were noted among the fauna such as numerous toads, small leeches, great water beetles and their larvæ, a most favourably report was ready long before the first ova had to be shipped. With this Major Godfrey wrote home suggesting that shipment should be made so that the arrival of the consignment might synchronize with the disappearance of snow from the Rawalpindi-Srinagar Road in the spring of 1900, but no special directions were given as to packing and shipping the ova as it was supposed that the Duke of Bedford, or his agent would be in touch with experts in England who had already made similar shipments. This hypothesis however proved wrong and shipment was made by a steamer with no cool room, with the result that the ova perished. Later in the year 1900 Major Godfrey went home on furlough and explained matters, arranging later with His Grace's Agent for a very early shipment of ova from Howietown (the well known trout found in Scotland) to be shipped by a P. & O. Mail Steamer which would reach Bombay in December in time to be forwarded to Srinagar before snow closed the road. This it did, ultimately arriving at my house in Christmas week in charge of Mr. J. Sidgreaves Macdonell who had gone to Bombay to meet the mail steamer. I would like here to record my thanks to the late Capt. Kitchen of the 5th Gurkhas for a diary account of an importation of trout ova made three years previous to this by him for his Regimental Club at Abbottabad. This account contained a useful hint regarding the packing case in which the ova was brought from Bombay. Since then we have found we can work safely with cases considerably less bulky but at that time I felt that no risks could be taken. Capt. Kitchen, who hatched out his ova in the swimming bath at Abbottabad was, when he sent me his diary, under the impression that his effort had failed entirely, but he afterwards discovered, and wrote me that some of the fish released in the Kalapani had survived and bred there. A subsequent attempt was made by the late Col. Kemball of the same regiment to re-stock this stream and to stock another river in the same district with ova from Kashmir. Possibly some of the trout from these importations still survive. One of my men, sent down two years ago at the instance of the Deputy Commissioner to make enquiries, reported that he actually saw one and were it not that every Gurkha Sipahi is a poacher at heart and that it seems impossible to control this tendency, I have no doubt than good trout fishing might be established in this district. But to return to our subject, Mr. Macdonell arrived late in the evening and we were busy till nearly midnight washing and transferring the ova to the hatching boxes which were ready in the verandah with pipe water laid on. About 6,000 appeared to be in good condition, a very fair proportion considering that they had travelled from England without any expert in charge, but we found many of these failed to hatch out and the mortality in the alevin and early fry stage was very distressing. The pipe water supply was a fertile source of trouble and had there been more than a thin wooden partition between the head of my bed and the hatching box, the fate which overtook an ova hatching exhibit (put up by me for the Punjab Exhibition at Lahore in 1911) during a failure of the Municipal Water Supply, might have brought an untimely end to my efforts. As it was the stoppage of the flow at night on several occasions woke me up and men were soon at work carrying water till the pipe supply again came in. In due course the fry stage was reached. Some of the little fishes were then transferred to a fry pond excavated in the compound, where they were hand fed and the remainder to a length of the Gupkar irrigation canal above Harwan, netted at both ends to prevent their escape, where they had to rely on the resources of nature for their sustenance. A wonderful little lot of yearlings finally came out of the fry pond. Much reduced in numbers thanks to water troubles but incredibly grown thanks to Sodhama's care in feeding them. One fish measured as much as 10½″ long (a record for a yearling of its age) when transferred in October to the Panchgaon ponds and sizes varied down to something under 4″. The yearlings from the canal on the other hand varied very little from a uniform length of 5″. By arrangement with the Durbar through Colonel (afterwards Sir Harold) Deane who was then Resident in Kashmir, the new stock ponds were made inside the area soon to be included in the Dachigam Rukh and some of the yearlings were released four to five miles up the Arrah river near Dachigam.

When subscriptions were first raised to import ova we had been given to understand that the Arrah river and possibly other suitable waters would with the approval of the Durbar be leased on favourable terms to the fishing Club of which the first subscribers formed the nucleus—Colonel Deane, however, considered that H. H. The Maharaja would be wrong to alienate State waters in this way and suggested instead that the State should find money to carry on the project up to at least the equivalent of what had already been subscribed privately: financial control to be exercised by the then newly formed Game Preservation Department and I to carry on the trout culture experiments as long as I cared to do so. Nothing however was done till Mr. Dane (afterwards Sir Louis) succeeded Sir Harold Deane at the Residency and the stream of Club subscriptions having dried up, funds in hand were exhausted. Then on my representing the urgency of the case, a visit to Panchgam was arranged and with a fly rod I lent him for the purpose, Mr. Dane dropped the first artificial fly on the stock pond there. A rush of the unsophisticated little beauties followed and one of them was on the bank in a twinkling. A day or two later Rs. 2,000 were placed to my credit with the Punjab Banking Company and "business as usual" followed till the great flood of 1903 swept over the land on the 24th of July and the spot on which the trout had been landed was three feet under it's waters. The trout enjoyed the flood thoroughly and when it was over the subsiding water found them settled in the holes and pools they had found most to their taste. Not one remained in the ponds. The spawning season was at hand, the redds (a common term for the gravelly shallow in which trout and salmon spawn) had been thoroughly cleaned by the flood and the trout had located themselves so as to have easy access to them. I suggested that they should not be disturbed as the opportunity was favourable for them to show what they could do in the way of reproducing their species under natural conditions and with this the new Resident Mr. (afterwards Sir Elliot) Colvin agreed. At the suggestion of the Durbar the new ponds were made at Harwan outside the Rukh and another consignment of ova from England was arranged for to stock them.

The policy of leaving the trout undisturbed in the stream was amply justified when the snow water had run off in the summer of 1904. Little troutlets were found in the streams below the reservoir when the water was cut off and subsequent investigation above the reservoir showed their presence in nearly every pool below Panchgam in more or less numbers. Earlier in the year the new ponds at Harwan were begun and were made of a much more permanent character than those destroyed by the flood. Three were considered sufficient for the first year—two being required for the fresh importation and one for some 200 small trout which had remained in a spring fed pond at Panchgam when all the bigger fish hatched from an importation of ova in 1902, which had not been very successful, had been transferred to the larger ponds only to be lost in the flood. When these were transferred to their new quarters in July 1904 the largest probably did not exceed 6 oz. certainly not 8 oz. in weight, but with more room and more food they at once began to grow amazingly. So much so that when Lord Minto visited Kashmir in October 1906 a trout of 12½ lbs. in weight was supplied from this lot as a special delicacy for his entertainment. This fish had increased its size quite 25 times in 27 months.

Upto to 1905 very little public interest was taken in the work though an occasional sportsman visitor who had heard of it drove out to see the new ponds at Harwan. Few believed that any great success was likely to be achieved. In the summer of that year the new Resident Col. Pears and his wife came out on 27th June to see what was doing and lunched with me in the Rukh. The stream was still fairly big with snow water, but after lunch I caught 8 or 9 nice little trout with fly above the old ponds at Panchgam and I also saw a very heavy fish jump in the old "Temple" pool there. A few days later Mrs. Pears told me with great amusement how when she had been relating their experiences on their return to Srinagar one gentleman had remarked "Oh! Mitchell just catches the same trout over and over again to make you think there are a lot of them."

I told one of my brothers of the big fish I had seen and as he was most anxious to have a try for it I asked him and three or four others to come out and spend the day with me on the 9th of July. I was delayed showing the others the ponds at Harwan and my brother went straight up to the pool where I had told him I had seen the big trout. When I got there it was gasping its last having fallen a victim to the lure of a fly spoon—a perfect cock fish of 5¾ lbs. We had him cooked at once for lunch and his fame went out into the land. Fishing began from that day and many big fish up to 9 lbs. in weight were killed the following summer when I was in England—nearly all on spinning tackle.

With the 1904 consignment of ova a small quantity of rainbow ova was shipped, but, being much more delicate than the *fario* ova, none hatched out and no further attempt was made to introduce the rainbow trout into Kashmir till 1912 when we succeeded in hatching out nearly 1,000 alevins from a consignment of ova presented by the Bristol Water Works from their head works at Blagdon and shipped by my old Calcutta chum Mr. (now Col.) W. W. Petrie by the P. & O. mail steamer. These dwindled down to a very small number before they reproduced their kind, but a fair stock has now been established at Harwan and with a better understanding of special complaints to which this species is liable, I hope to see them giving fine sport before long in waters which are rather too warm for the brown trout.

In February 1905 the first ova was collected from trout in Kashmir. There were only a few ready to spawn and my men had had no experience in handling them, so I arranged an artificial spawning bed with a wire net trap for the ova and I left the trout to select their own season. About 2,000 ova were collected in the net and of these only some 900 proved fertile and hatched out. Unfortunately a Himalayan Water Shrew got into the box one night and ate all but one of the little alevins. Having done this he found he could not get out again and next morning he was floating on the water drowned. The following season we began stripping the trout and fertilizing the ova and in 1908 a proper hatchery was built from which eyed ova up to a maximum of 1,000,000 have been issued yearly since that time. These have been distributed to fry ponds and spring streams all over Kashmir including Gilgit and have been hatched out chiefly in Pahari boxes well described in Mr. Howell's article on "The making of a Himalayan Trout Stream." Ova have been also sent to Abbottabad, Kangra, Kulu, Simla, Naini Tal and Shillong (Assam) as well as to a number of Native States all in charge of men trained at Harwan, who have conveyed the consignments safely to their destination, generally with a loss of less than 1 per cent. in transit. Perhaps the most difficult journey to negotiate successfully was to Gilgit on which 200 miles of road crossing passes of 12,000′ and 15,000′ had to be traversed *in December*. The first effort was a failure, the ova having been frozen, but the second succeeded and I understand that officers of the Agency now have fair trout fishing in at least one stream. For this Col. A. B. Dew and Col. Macpherson have to be thanked. The former having commenced and the latter carried out I believe chiefly on their own expense most of the hatchery work in Gilgit with the help of a man from Harwan. In the Valley of Kashmir most of the more accessible streams suitable for trout fishing are now fairly stocked and some of the more distant waters have been taken in hand. The high lakes which by many were considered unsuitable owing to their being frozen over, in some years as late as the end of June, have given one conspicuous success. Unfortunately there is a question of sanctity about the lakes so far stocked and permission to issue fishing licences has not been granted by the Durbar. Other lakes have, however, been taken in hand with good prospects of success.

Before closing this account I should mention that in 1908 an attempt was made to introduce the great Danube Salmon (*S. hucho*) into Kashmir. Ova was arranged for through a well known Continental pisciculturist and was shipped *via* London to Calcutta at considerable trouble and expense. The consignment arrived in Calcutta on 9th April (nearly the hottest season of the year there) I met and took it up to Kashmir where the little fish hatched out and appeared quite healthy, but none grew to over half a pound in the first two or three years. An enquiry kindly made on our behalf by Mr. R. B. Marston of the "Fishing Gazette" resulted in some correspondence being published in that paper in which the firm who sold us the ova admitted that they had been unable to obtain guaranteed ova from the Government hatchery and had sent us some from a private hatchery which *might* have been a late lot of Salmon (*S. salar*) ova. The scales of the little fish indicated that this was the case. After three or four years respectively the cocks and hens of this batch reached the reproducing stage and were experimentally cross bred with *S. fario*, but the resulting fish did not grow well. Cross breeding was carried on to the third generation with no signs of a "mule" tendency, but the fish were not satisfactory and were finally all released. Some of the original fish ultimately reached a size of over a pound in weight and had the spotty look of a bull trout, but after the early stages, none of them seemed to feed well except on live water insects and flies.

F. J. MITCHELL.

SRINAGAR, KASHMIR, 1918.

No. XXII.—NOTES ON THE LARVA OF *CHÆROCAMPA ALECTO.*

I found eggs and larvæ of this moth at Rae Bareli, U. P., at the end of October and in November 1917. The food plants were the cultivated vine, and a small plant growing near marshy ground, with a flower shaped like a clove.

The eggs were spherical and bright green in colour, about the same size as the eggs of *Daphnis nerii*. They were laid singly, usually on the upper side of a leaf.

The larva when first hatched was light yellow, with a long thin black horn. After the first change of skin ocelli began to appear on the sides.

At the second change of skin the larva assumed either a green or a brown colour.

In the green from the head and body were green, with a darker dorsal line. On each side there was a series of seven ocelli on the fourth to the tenth body segments, either reddish or blue, ringed with black, and a yellow sub-dorsal line commencing at the second segment and running through the ocelli to the horn. Horn long and thin, reddish at the base with a black tip. Legs pink, prolegs and claspers green.

After the third change of skin the colour became yellowish-green, dotted with darker green. The third and fourth body segments became swollen, and the ocelli on the fourth segment larger than the others. Ocelli reddish, ringed first with yellow and then dark green. Horn same as before.

After the fourth change of skin, which is the last before turning to a pupa, the head and the first three segments were apple green, the other segments yellow in the dorsal area, green underneath, dotted and striped with darker green. Legs and spiracles red, horn purple, strong and pointed and curved sharply downwards. Ocelli green ringed with yellow and black.

When full grown the larva was three and a half inches long. The brown form was coloured as follows :—Head and body brown, body dotted with brown from the fifth segment to the horn. First pair of ocelli black ringed with yellow and black. Seven oblique stripes brown. Spiracles blue, horn purple, legs red, prolegs and claspers brown.

The pupa was a dirty brown colour, with black spiracles and dark lines and dots. In front of the head, and joined to it, was a circular flattened sheath, containing the proboscis.

The pupæ were formed at the beginning of November 1917, and the moths hatched on the 1st of March 1918.

The green and brown forms both occurred together on the smaller food plant, which had both green and brown leaves. All found on the vine were green.

A large proportion of those reared from the egg assumed the brown form, either at the second or a later change of skin.

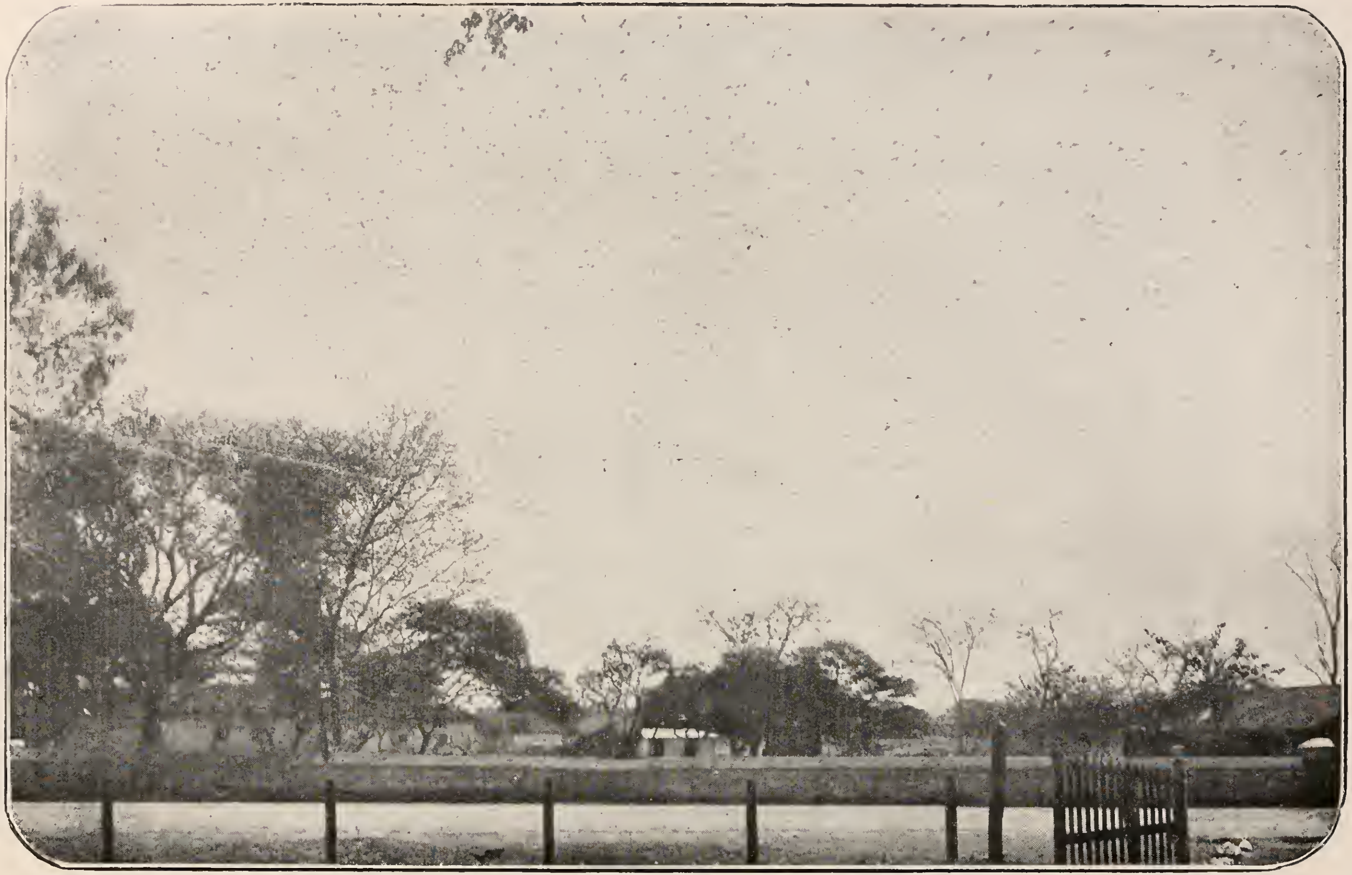
F. B. SCOTT, Captain, I.A.

Hyderabad, Sind,
12th May 1918.

No. XXIII.—LIFE HISTORY OF THE *ANTHERÆA ROYLEI* (OAK EMPEROR) MOTH.

On the morning of the 1st September 1917 I found a male and a female of the moth. The male had just separated from the female. I pinned the male and put the female in a box and she commenced to lay her eggs immediately. The first eggs hatched on the 11th September, and the first caterpillars moulted as under :—

1st moult	commenced on the	18th September	and completed	19th Sept.
2nd	do.	25th do.	do.	26th do.
3rd	do.	1st October	do.	3rd Oct.
4th	do.	9th do.	do.	11th do.
5th	do.	17th do.	do.	19th do.
6th	do.	23rd do.	do.	24th do.
7th	do.	28th do.	do.	30th do.
8th and last moult		2nd November	do.	3rd Nov.



A Flight of Locusts at Poona—1903.

The first caterpillars began to spin their cocoons on the 9th of November 1917. The first batch of moths from these cocoons hatched on the night of the 9th March 1918. These were four males. On the 13th some females hatched and were set out on the night of the 14th. Males were caught on them, and the females started to lay on the 15th. The caterpillars from these began to hatch on the 25th March 1918. The first caterpillars from this batch spun their cocoons on the 20th June 1918. The second batch of moths from these turned on the 29th July 1918, and some females were set out the same night and males taken. The moths laid on the 30th July 1918, and the eggs hatched on the 9th August 1918. According to the time the first batch took to spin their cocoons, *i.e.*, two months. This batch should begin to spin on the 7th October 1918. From this it will be seen that there are three batches of cocoons in the year. The caterpillars are easy to breed in captivity and copulate freely if kept loose in a room. In the first batch raised, I had 150 eggs, out of which I got 142 cocoons. The caterpillars were fed on oak leaves (*Quercus semiserrata*). Till the second mould had been taken, the caterpillars were kept in a card board box with a tight fitting lid. After this they were put on to branches of the oak which were stood up in a bottle with water in it. And this again was stood up in a zinc bath tub to prevent any caterpillars falling off, getting away and being lost.

The caterpillars are hardy and are easy to breed, and the silk appears to be of good quality, and ought to be of commercial value if grown on a large scale, but nobody in Burma seems to have the enterprise to do it.

I am sending you under separate cover males and females of the *Antheræa roylei*, also some empty cocoons of the same. Also a skin of the Wood snipe, *G. nemoricula*, which was shot up here last March.

C. W. ALLAN,
Deputy Conservator of Forests,
Mandalay Division.

MAYMYO, BURMA,
14*th August* 1918.

No. XXIV.—A FLIGHT OF LOCUSTS.

(*With a Plate.*)

The accompanying photograph was taken by Lt.-Col. P. H. Rogers, K.O.Y.L.I., in 1903, and represents the locusts crossing the compound of the Club of Western India, Poona. If a magnifying glass is used the shape of some of the locusts in the photograph can be plainly seen.

E. C. B. ACWORTH.

BOMBAY, 14*th December* 1917.

No. XXV.—NESTING HABITS OF *VESPA DORYLLOIDES*, Sauss.

Specimens of a Wasp *Vespa dorylloides*, Sauss., and a dynastinid beetle *Blabephorus pinguis*, Fairm., were recently sent me by Mr. A. J. S. Butterwick, Extra Assistant Conservator of Forests, Instructor, Burma Forest School, with the following account of the conditions under which they were taken:—

" On the 22nd of last month (March 1918), I had occasion to burn out the nest of a kind of yellow wasp (probably a species of *Vespa*), which had been giving my men and myself a lot of trouble as they had frequently attacked us in the dark, and as their stings were extremely painful and long lived. The Burmans call them *padus*. The nest was located inside the hollow .of a teak tree near our camp (Pyinmana Forest Division, Burma). To show me that they did not attack at a distance by day, a Burman shoved his head (this was at 11 a.m.) right into the hollow to look for the nest and he was not touched. After the nest was well burnt and smoked, it was taken out and shown to me. There were altogether 6 circular tiers one over the other. Each tier was about 1¼″ thick and was separated from the adjacent ones by spaces about ½″ broad. The tiers were however joined at their centres to each other by 2 or 3 thin pillars of the same papery material as the whole nest was made of. When looking into these spaces to my great surprise I found inside them a large number of (apparently) the common three-horned rhinoceros beetle. I could not make out exactly what these beetles were there for, as most of them had died from the effects of the fire. The Burmans call them "*Padu min*" (King of padus) and allege that they are always found in these wasps' nests and that they devour the grubs and young pupæ. I am not sure whether what they say is correct, or whether the mother wasps sting and paralyse these beetles and bring them to their nests for food for their young ones."

The above is of interest as the nest of *Vespa dorylloides* does not appear to have been described before. Du Buysson, who monographed the genus in 1904, says (Ann. Soc. Ent. France., LXXIII, pp. 617-618) on the authority of a correspondent in Sumatra, that "this wasp exhibits crepuscular habits, flying by evening at nightfall. It comes to light during meals, and makes off with what food stuff it can seize. During the day it appears to be distressed by the direct light of the sun and flies as if deprived of sight colliding with anything before it. The natives have given it a name which means "blind". It is very irritable and its sting is fairly painful. It lives in old and very thick forests in which it makes its nest in the soil."

It seems most probable that the beetles were accidentally associated with the wasps, that they were sheltering in the hollow tree and were driven by the smoke into the interspaces of the wasps' nest, I should be very glad to hear of any other explanation or similar occurrence.

C. F. C. BEESON, M.A., I.F.S.,
Forest Zoologist.

DEHRA DUN, 18*th June* 1918.

XXVI.—MIMICRY IN SPIDERS.

In a chick-house at Muzaffarpur a few days ago I saw a distinct attempt of a spider at imitating a *Hymenocallis* Lily. The threads of the web were to be seen with difficulty against the background and in the centre a cross of two or three inch arms had been made to show up white by means of many cross threads. Towards the centre the white changed to a misty grey colour into which the head of the spider toned exactly. The spider itself stood in the centre with its legs doubled together up the arms of the cross, the colour of the legs being sepia and cinnamon in bars. The body of about half an inch long was for the front two-fifths of a creamy yellow crossed by two very fine black stripes and the remainder was a very dark brown, almost black, with fine yellow spots and was divided into two nearly equal parts by a broad cross band of cream colour shading to gamboge.

Altogether the imitation was most successful, so much so that I thought it as well to see if the spider also emitted any scent like that of a lily, but he (or she) appeared to have omitted that detail.

F. CLAYTON.

RANCHI, 1*st July* 1918.

No. XXVII.—ON THE BREEDING HABITS OF SOME *MYRIAPODA*.

Very little seems to be known about the breeding habits of the *Myriapoda*. The two more important orders of *Myriapoda* are: The *Chilopoda* and the *Chilognatha*.

The former are well represented in India by the family *Scolopendridæ*, a group of common centipedes. With regard to the breeding habits of these, opinions differ considerably. Sinclair, in the Cambridge Natural History, Vol. V, p. 39, says: "The *Scolopendridæ* are said to bring forth their young alive, but I think the evidence for this is unsatisfactory. What have been taken for the young *Scolopendridæ* are perhaps the large spermatophores of the male, which are not unlike a larval Myriapod in size and shape. I have never been able to observe the process of breeding in this family. I have had the spermatophores sent me from Gibraltar as "eggs", but a little examination soon showed me their real character." To what genus those spermatophores belong. Sinclair does not tell us. The information given by Sedgwick in Vol. III, p. 600 of his Student's Text-book of Zoology goes a little further. He says: "It has been stated that some of the *Scolopendridæ* are viviparous. However this may be, the majority of the Chilopods appear to be oviparous. Lithobius lays its eggs singly and rolls them in the earth. The European species of *Scolopendra* lay (in June and July) from 15 to 33 eggs (about 3 mm. in length) in the earth (3 to 8 cm. deep) and roll themselves round them, protecting them from contact with the earth and keeping them moist by a fluid secretion until they are hatched, which takes place after some weeks. *Geophilus* also has been observed to take care of its eggs in a similar manner." Hayek (in Zoologie, Vol. II, p. 172) is more general in his statement. According to this authority no union takes place between the two sexes. The male spreads a few threads on the ground and attaches its spermatophores to the network. The female walks over the threads and receives the spermatophores into the vagina. Verhoeff is more definite. He distinguishes two classes of *Chilopoda*: The females of one lay their eggs singly and cannot, therefore, take care of the eggs and the young ones. To this class belong, v.g., the *Scutigeridæ*. The females of the other class lays a number of eggs into a hole and surrounds or covers them with her body. Here belong the *Geophilidæ* and *Scolopendridæ*.

It is apparent from these statements that our knowledge of the breeding habits of the *Chilopoda* is very meagre, and sometimes contradictory. It seems that almost every species has to be observed before we can draw general conclusions.

I have repeatedly had occasion of observing one of the common centipedes, *Scolopendra morsitans*, L., at Khandala as well as in Bombay. The full-grown Centipede is about 10 cm. long, with a metallic lustre on its back, the undersurface being yellow. At Khandala I have seen eggs in the months of May and June. The eggs numbered from 20 to 30. They are elliptic, soft, surrounded by a thin tough skin, and of a cream colour. They were loosely stuck together by some glutious substance and could easily be separated from each other. The mother Centipede takes care of her eggs by winding herself round them and keeping the eggs together with her legs and keeping them away from the soil. After some period the eggs are hatched and the young ones emerge quite soft and white, about 1 cm. long. The mother nurses also the young ones in the same manner for some time. When they are big enough they have to look out for themselves. I have observed the young ones in July in the persistent leaf-sheath of a Palm.

As to the other order of *Myriopoda, viz.*, the *Chilognatha* or Millipedes, a little more seems to be known with regard to the breeding habits, though even here some writers have been generalizing too much. Sedgwick v. g. says that "the eggs are laid shortly after copulation, in masses in damp earth, under stones, etc. Sometimes a kind of nest is made, and in some species the mother keeps watch over the eggs." Hayek makes the same statement. Sinclair who succeeded in bringing some specimens of *Polydesmus* alive from Madeira to England, and in getting them to breed, observes that "their way of laying eggs and making a nest resembles that of *Julus*, which is known to lay 60 to 100 eggs at a time in a small nest in the ground. I have been able to observe a species of *Polydesmus* in Bombay, in the month of October. When removing a plant with the soil from a flower pot I noticed on one of the pieces of a broken flower pot (which the malis use to put inside in the bottom) a dome-like strncture made of earth and about 1 cm. in diameter. On opening it I found a young *Polydesmus* curled up in the cavity of the dome. It was about 1 cm. long, quite soft and completely white. On examining the other broken pieces of the flower pot I found 5 or 6 more of those domes, each one containing one young *Polydesmus*. From this it is evident thal at least one Indian species of *Polydesmus* does not lay its eggs in masses, but singly, enclosing each in a mud dome. What the young Millipedes are feeding on during the first time of their development I cannot say. But it seems that the young larva eats its own moult, as, in some cases, I have seen only half a moult left in the cavity. Of course this self-devouring process cannot increase the size of the larva, and I wish to add that I have not seen them actually eating the moult.

C. McCANN.

ST. XAVIER'S COLLEGE BIOLOGICAL LABORATORY,
BOMBAY, *April* 1918.

No. XXVIII.—NOTE ON A NEW UNDESCRIBED SPECIES OF *CYNODON* BY K. RANGACHARI AND C. TADULINGAM.

(*With a Plate*).

Specimens of this grass collected in the Godavari District were left unidentified for want of sufficient material. We obtained last year sufficient material by growing plants from a specimen collected on the Nilgiris near Kallar. This is named *Cynodon intermedius*, as it resembles in certain respects *Cynodon dactylon* on the one hand and *Cynodon barberi* on the other.

Cynodon intermedius, sp. nov.

This grass is a widely creeping perennial.

The stems are slender, glabrous, creeping superficially and rooting at the nodes. but never rhizomiferous, leafy with slender erect or geniculately ascending flowering branches, and varying in length from 12 to 18 inches; nodes are slightly swollen, glabrous, green or purplish.

The leaf-sheath is smooth, glabrous, slightly compressed, sparsely bearded at the mouth, shorter than the internode, except the one enclosing the peduncle which is usually long; the ligule is a shortly ciliated rim.

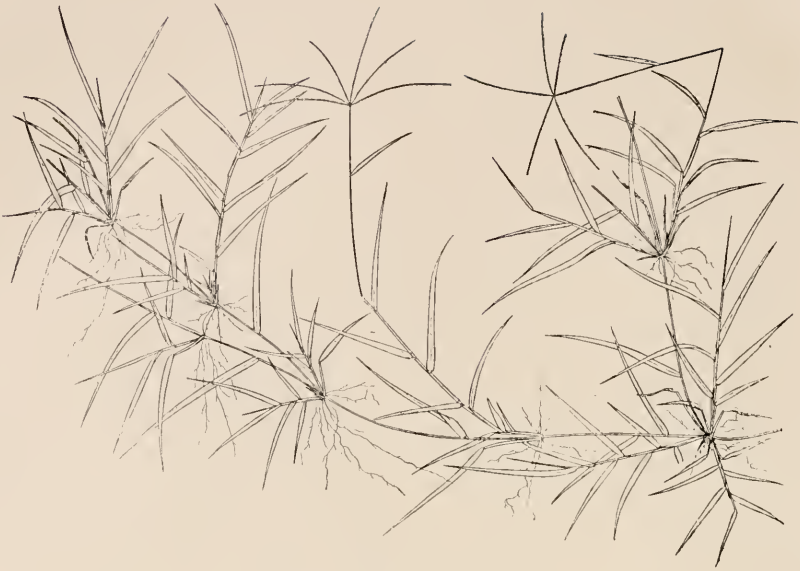
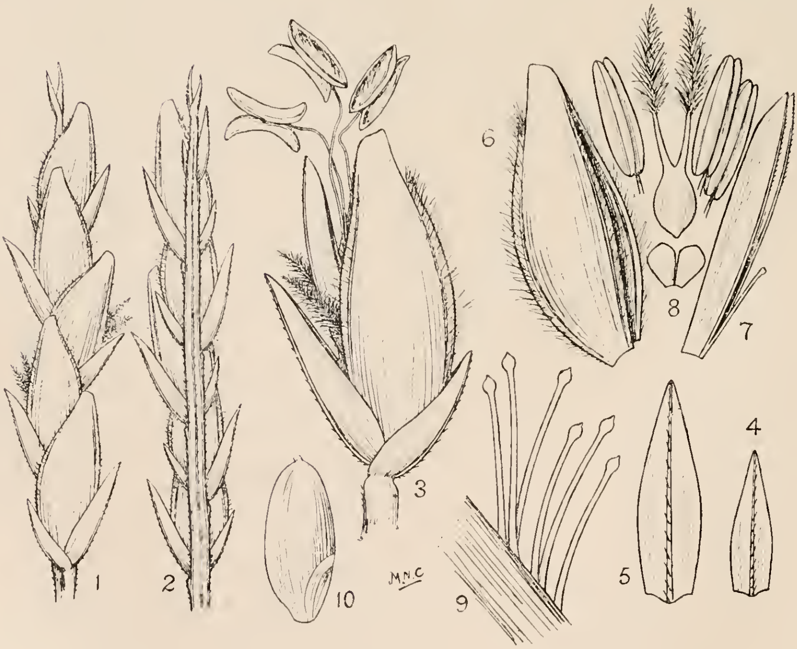


Fig. 1.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M.N.C.

Fig. 2.

CYNODON INTERMEDIUS, sp. nov

The leaf-blade is linear, flat, finely acuminate, scaberulous above the margins, smooth below except in some portions of the mid rib, $\frac{1}{2}$ to 7 inches in length and $\frac{3}{16}$ to $\frac{1}{4}$ inch in breadth.

The inflorescence consists of four to eight long, thin, slender, slightly drooping, digitately arranged spikes, 2 to 4 inches long on a long smooth peduncle; the rachis is tumid and pubescent at its base, slender, somewhat compressed and scaberulous. The spikelets are rather small, narrow, greenish or purplish, $\frac{1}{15}$ inch long or less; the rachilla is slender, produced to about half the length of the spikelet behind the palea.

There are three glumes. The first and the second glumes are lanceolate, acute or acuminate, one-nerved, keel obscurely scabrid, very unequal, the first glume being always shorter than the second glume. The third glume is obliquely ovate-oblong, chartaceous, longer than the second glume, obtuse or subacute, and three-nerved; the margins and keel with close set clavellate hairs pointed at the apex; palea is chartaceous, 2-keeled, keels obscurely scaberulous and without hairs. There are three stamens with somewhat small purple anthers. Ovary with purple stigmas and two small lodicules. Grain is oblong reddish brown, with a faint dorsal groove.

The species is closely allied to the cosmopolitan species *Cynodon dactylon*, Pers., and to another new species *Cynodon barberi*, Rang. & Tad., described in the journal of the Bombay Nat. Hist. Society, Vol. 24, Part IV, page 846, and it is therefore named *Cynodon intermedius*. This grass differs from *Cynodon dactylon*, Pers. (1) in not having underground stems and having only stems creeping and rooting along the surface of the ground, (2) in having less rigid leaves, (3) by having longer, slenderer, somewhat drooping spikes and narrower spikelets, (4) by having the first two glumes always unequal, the 2nd being longer, (5) by having clavellate pointed hairs on the margins and keels of the third glume and 6 by having smaller anthers. Compared with *Cynodon barberi*, this plant is more extensively creeping with longer slender branches and the leaves are usually very much longer and the third glume is longer than the second.

Distribution.—So far, this was collected at Gokavaram in Godavari District (No. 8262), in Chingleput (No. 11488), Tinnevelly District (Nos. 13129 and 13259) and at Kallar on the Nilgiris (No. 13988).

EXPLANATION OF PLATE.

Fig. I. Full plant.
„ II. Spikelets and parts of a spikelet.

1. front view of a portion of spike; 2. back view of a portion of a spikelet; 3. spikelet; 4. first glume; 5. second glume; 6. third glume; 7. palea; 8. lodicules, stamens and ovary; 9. hairs on the third glume; 10. grain.

K. RANGACHARI.

Govt. Lecturing Botanist.

COIMBATORE, 4*th April* 1918.

No. XXIX.—A VARIETY OF *BUTEA FRONDOSA*.

In March 1918, while inspecting villages in the Manpur pargana (British area) in the Central India Agency, I came suddenly on most glorious sight. A single tree of golden yellow *Butea frondosa*. The tree is about 30 feet high and was at that time a mass of blossom. The flower differs in no way from the ordinary variety except in colour. The Forest Ranger, who was with me, said that in the Central Provinces, to which service he belongs, he had seen a yellowish white variety, but nothing like this. The colour in this case is similar to that of a Sun-flower. A variety which would appear to be similar to that found in the Central Provinces is referred to in Vol. VI of the Journal, page 107. Neither the Flora of British India, Brandis, Gamble or Talbot refer to any such variety or this. I have secured its seed, some of which I sent to Mr. Millard, and it will be interesting to see if it flowers true.

C. E. LUARD, Lt.-Col.,
Political Agent in the Southern States
of Central India.

Manpur, C. I.,
June 18th, 1918.

No. XXX.—THE EDIBLE DATE-PALM IN BOMBAY.

On the 11th July Mr. Millard sent me the fruits of the Date-Palm (*Phœnix dactylifera*), growing in the Bombay University Gardens. The malee informed him that the tree fruited every year and that the fruits fall off before they are mature.

The fruits are green or yellowish green and about 1 inch long. The complete absence of a seed shows that they have apparently not been fertilized. There is a small empty cavity in the flesh which imitatos in its shape (but not in its size) the stone or seed of the fruit.

The usual process after fertilization is this : Out of the three free simple ovaries of the flower only one ripens into a berry, the pericarp becoming the pulp which contains a " stone " or seed. The latter is a solid mass of horny perisperm with the embryo embedded in a small cavity a little beneath the surface, its place being indicated by a papilla on the surface.

In the fruit under examination the pericarp alone has developed, the rest being abortive ; oach fruit is supported at its base by the complete perianth thus showing that only one of the 3 ovaries has developed into a (seedless) fruit, whilst the others have disappeared.

Of these facts one is old, and one seems to be new. It is well known that, in case there is no pollination, all three of the ovaries will develop, but will be seedless and the fruit will be inferior. In our case, however, only one ovary in each flower has developed, a behaviour quite different from what has been observed up to now (at least to my knowledge). Is it not possible that the stimulus for the formation of the fruit was given by pollen of the Wild Date Palm (*Phœnix sylvestris*), but that the stimulus was not sufficient to produce a seed ? It would be easy to ascertain this point during the flowering season of the Palm.

E. BLATTER, s.j.

Botanical Laboratory,
St. Xavier's College,
Bombay, *13th July* 1918.

No. XXXI.—OLEANDER POISONING CAMELS.

Does anybody know why Oleander is such a deadly poison to camels ? The theory here is that the leaves choke the camel, and that dried leaves are more fatal than green ones. Is it known what the poison is, and what antidote, if any, there is ? A man in the Telegraph Department told me to-day that he had saved the life of one of his riding camels by giving it within ½ hour of its eating the oleander leaves, 2 bottles of tea, 3 bottles of strong solution of permanganate of potash, and two bottles of ghee ? Apparently no symptoms of poisoning were seen.

Of course the purely local systems of treatment for all camels' diseases are (1) branding, preferably as far away from the seat of the disease as possible, *e.g.*, heal for a toothache and (2) ghi, kerosine oil and sweet oil in varying proportions internally or externally. But I have never met any one yet who really knew anything about camels.

J. E. B. HOTSON, CAPT. I.A.R.O.

PANJGUE, *via* NUSHKI,
March 1918.

[The Revd. E. Blatter, S.J., commenting on the above query writes: Before speaking of the poisonous qualities of the plant mentioned by Capt. Hotson, I wish to make a remark on a systematic point regarding two species of *Nerium*.

Nerium odorum, Soland., has been found up to now in Afghanistan, Baluchistan (Persian as well as British) up to 6,000 feet, in the outer N. W. Himalaya up to 5,500 feet, in Central India and China. It has a predelection for rocky stream beds or ravines and river beds which are dry in winter. It is generally grown in Indian gardens with single and double white or pink flowers. *Nerium oleander*, L., however, is a common shrub in the Mediterranean region, Western Asia, Syria and Kurdistan. Kirtikar wrote in Vol. XI, p. 254 of this Journal: "It must now be considered that the *Nerium odorum* . . . is no other than the *Nerium oleander* of the Mediterranean coast, barring developmental differences due to climatic influences. Linnæus is after all right in considering that they were identical plants. However much the corolla may vary in the two plants, we have the high and unquestionable authority of Brandis that the fact of a mere climatic variation of the corolla does not afford distinctive characters of a reliable kind. Special parts may vary, but yet their variation need not go to multiply varieties which may reasonably be classed under one and the same species."

It seems to me that, if we want to settle this point, we have to compare wild-growing specimens of the two species. It is no use taking plants which have been under cultivation for a long period. Capt. Hotson has sent us specimens of what we consider to be *Nerium odorum* from various parts of Persian and British Baluchistan as well as from Makran. In most cases we are sure that they have not been introduced or cultivated in those localities. They differ from *Nerium oleander* in the following points :—The plant is less robust; the leaves are commonly narrow and more distant; the branches are angled; the calyx lobes are erect (in wild specimens of *Nerium oleander* they are spreading); the appendages of the corona are cleft into numerous filiform segments, or are trifid, the lateral segments being linear, the central one short-triangular (whilst in *Nerium odorum* the segments of the appendages are short, irregular, and not linear or filiform; the appendages of the anthers are protruding (not protruding in *N. oleander*); the fruit is 6-9 inches long (in *N. oleander* 3-6 inches), the flowers are fragrant (in *N. oleander* inodorous). I am inclined to think that all these differences taken together justify our retaining *N. odorum* as a distinct species.

Now to the poisonous qualities of the shrub. Here we need not make any distinction between the two species, as experience has shown that both exhibit the same toxic properties. Pliny is the first to mention the Oleander. He writes: "The rhododendron (our Oleander) has not even found a name in Latin. They call it *rhododaphne* or *nerium*. It is strange that its leaves should be poisonous to all quadrupeds, but to man an antidote against snake-bite, if they are taken in wine together with rue. Also cattle and goats are said to die if they drink of the water in which the leaves have been soaked." (Plin. Nat. Hist., XXIII, 11, 90 (Edit. Teub.)). Dioscorides, a contemporary of Pliny gives even a description of the plant and adds: "A well-known bush which has longer and thicker leaves than the almond tree. It grows in gardens, on coast lands, and beside rivers; its blossoms and leaves have a bad effect on dogs, asses, mules, and most quadrupeds; but taken with wine, they are wholesome for men against the bite of animals, especially if mixed with rue; but when the smaller animals, like goats and sheep, drink of this. they die." Palladius says that mice can be destroyed by stopping up their holes and passages with Oleander leaves. Considering that the Romans received the name of the bush from Greece, it is difficult to understand that not one Greek writer mentions the plant.

To the Hindus the poisonous qualities of Oleander have been known for a long time. "It is proverbial among females of the hills," says Dymock, "to bid each other go and eat the root of the Kaner. Ainslie also refers to its use by Hindu women, when tormented by jealousy, and Broughton says that it is well-known and extensively used in the Bombay Presidency as a poison, the juice from the red variety being considered the strongest and most fatal." Balfour mentions that the camels eat leaves and usually die in consequence of it.

Chemical analysis has shown that the leaves of the Oleander contain two substances which are chemically different and free of nitrogen, *viz.*, Oleandrin and neriin (1). Both are non-crystallisable glucosides, almost insoluble in water. Oleandrin forms amorphous masses which are soluble in alcohol, ether, and chloroform, but only slightly so in water. Neriin may prove to be identical with digitalein, but in the meantime it goes under its specific name. Schmiedeberg, who examined leaves of the African plant, was able to separate a third product, which he called neriantin. Regarding its chemical and physiological properties it is similar to digitalin.

Both, oleandrin as well as neriin, are heart poisons and their effects fairly agree with those produced by digitalin (the poison obtained from the foxglove, *Digitalis purpurea*). The pulse frequently diminishes in the first stage, while the pressure of the blood rises: then the blood pressure as well as the pulse frequency become abnormally low, and finally the pressure remains low, whilst the pulse beats above the normal frequency When the pulse becomes very low, it is natural that a feeling of constriction and uneasiness in the chest comes on (called choking in Capt. Hotson's letter). But the aspect of oleander-poisoning is not always so uniform and the symptoms may be altogether peculiar in certain cases. Interesting instances have been described in the Transactions of Med. and Phys. Soc. of Bombay. 1857, 1858 and 1859.

The antidotes, too, are the same as those applied against digitalin poisoning. Wynter Blyth recommends the following:

"Empty the stomach by the tube or pump, or administer a subcutaneous dose (4 drops) of apomorphine, or give a tablespoonful of mustard in water, or sulphate of zinc.

"Follow up with strong tea, or half a drachm of tannin, or gallic acid in aqueous solution.

"A very small dose of aconitine nitrate in solution (say 1/200 of a grain may be injected subcutaneously and the effect watched; if in a little time it seems to be good, repeat the dose. On no account let the patient rise from the recumbent posture, or he may faint to death.

"Stimulants in small doses may be given frequently by the mouth, or, if there is vomiting, by the bowel."

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(1) A. Wynter Blyth, Poisons. London, 1895.

It is not easy to see the use of permanganate of potash and ghi, which were recommended to Captain Hotson. If a good effect followed the administration of the medicine mentioned, it must be ascribed to the tea on account of the tannic acid it contains.—E. B.]

No. XXXII.—NOTES FROM THE ORIENTAL SPORTING MAGAZINE, NEW SERIES, 1869 to 1879.

Bears: The late Colonel Nightingale speared many bears in the Hyderabad country, mostly, if not entirely, off Arab horses.

At pages 82 to 85 of Vol. XI a contributor relates the spearing of a number of bears, and some hyænas, in the Nirmal jungles (Hyderabad, Deccan) and relates the amusing sequence to a visit of a man-eating tiger to his camp. The local "Cutwal" or Jemadar of Police suggested the artful dodge of dressing up a sheep in garb of a man! The device was tried and did not answer, and indeed appeared, as well it might, to keep the tiger away from the camp.

At page 164 the exciting sport of spearing bears by moonlight is graphically told.

Rhinoceros: A sportsman, "T. A. D.," relates in Vol. IX, 1876, p. 557, *et seq.*, his sport in shooting Rhinoceros, in the Bhutan Dovars, off an elephant. No wonder that these unfortunate animals have woefully decreased in numbers! Such sportsmen were not entirely to blame as witness the following: "W" writes at p. 638. "The shooting in the Dovars will not last much longer. I was credibly informed that the "Pahlwaris or shikaris had killed no less than 200 Rhinoceros."

Here is "T. A. D.'s" account of his own doings. "The sun had set for some time, and I was obliged to give in: but I had bagged five rhinos in in that one day, and had wounded at least five times five more, a good many of which must have died. . . . My hands were blistered and bleeding with loading and I had broken two ramrods. I must have fired at least a hundred shots that day." The rifle used was a 12 bore and the locality East of the River Torsak near Patla Khowah in the Bhutan Dovars.

Wolves: There are recorded several instances of the riding down and spearing of wolves, and also of black brick. An instance of wolves hunting by concerted plan is also related.

The Wild Ass: At p. 276 of Vol. VI, 1873, is an account of the hunting of wild donkeys in the Runn of Cutch. Some 30 to 50 horsemen took part in the drive which resulted in one young ass being run down and captured in 3 hours and 5 minutes (6-25 to 9-30 a.m.) the distance covered being estimated at 40 miles.

Various incidents: In Vol. IV (p. 328) a contributor writes that near Dehra Dun, a panther was killed by a Ghoorka recruit who threw a stone at it and fractured its skull. The man came on the beast as it was drinking at a pool in a nala.

It is not uncommon in the Lower Himalayas for panthers to be killed by the hillmen with their axes, but the doing in of a panther by a hand thrown stone must be a very unique performance.

At p. 83 of Vol. XII is a note of an elephant having been bitten by a mad dog, and dying of hydrophobia.

The spearing of a nilghae off Arab horses in Kathiawar is related: not a difficult feat in suitable ground.

The "Pheo" call: In the same volume a contributor writes that the "Pheo" call is uttered by a jackal and that this cry indicates that some wild beast of the feline tribe is afoot. This is also the writer's experiency, though it is not infallible, as on one occasion the cry was clearly caused be the presence of a hyæna.

Crocodiles: One wonders whether the eyes of the contributor of the following note did not deceive him. He relates that he saw young alligators (*sic*) entering their mothers' mouth and going into her stomach and coming out again! (Vol. II, p. 1521).

Buffalo: At p. 1873, Vol. VI, is a record of a cow buffalo killed in Assam: horns 13′ 6″ on the outer curve and 6′ 6″ tip to tip.

Doe chinkara: A doe chinkara with 9″ horns is recorded. This must be nearly a "record." The writer has heard of an 11″ head having been lately obtained in Sind, but has not yet been able to procure verification of this.

At page 1 of Vol. IV of 1871 is an interesting sketch of head of a doe antelope with horns. The animal was shot near Ahmednagar.

Red Ants: The following assertion deserves a paragraph all to itself: "Castor oil smeared round the tree trunk and boughs above and below the sitter in a tree will keep off the red ant." If this be so, it is worth knowing! Many a sportsman has been speedily dislodged by the vicious red ant with its vitriolic bite. On one occasion the writer lost a shot at a panther solely owing to the attentions of red ants.

Snipe shooting: A Subaltern in the Arrakan Battalion won a wager that he would bag 100 couple of snipe in six hours. He won his bet, shooting 126 couple between 10 a.m. and 4 p.m. using two muzzle loaders. His performance was verified by the chaplain, and a very fine performance too.

Some curiosities in Natural History: The greediness and voracity of eels is well-known, but the eel of 2′-4″ choked by attempting to swallow a brother eel of 2′-9″ must have had a most unusual twist to his appetite.

Frank Buckland relates a fight between a scorpion and a mouse in which the latter was victorious. Combats of a similar kind—Scorpion *versus* "Jerrymundlam"—a species of spider with jaws in four segments used to afford much after dinner amusement at a small military station a good many years ago. The arena was the surface of table cloth covered by an inverted finger bowl. Victory went either way according to the agility of the combatants. The point of attack, as in case of the mouse, was the junction of poison bag to the body, but, contrary to the experience of the mouse, the sting of the scorpion used to be very speedily fatal to the spider.

Birds: At p. 81 of Vol. VI, 1873, is a very useful list by A. Manson of the birds of Orissa. The English and Ooria names are given.

A list of the Orissa Mammals is at page 458 of Vol. V, 1872.

Some carefully ascertained weights of Floriken are given:

Four Cocks ..	18½	18½	16¾	16½	ounces.
Four hens ..	23½	22¼	21	18	ounces.

Mahseer Fishing: Several contributors give short accounts of the excellent Mahseer fishing to be had in Assam. No doubt similar sport can be had at the present day.

11th to 15th February ..	42 fish	av. 20½ lbs.
19th to 26th December ..	28 „	3 to 40 lbs.
21st Oct. to 22nd Nov. (1875)	34 „	av. 31½ lbs.

Among these were several over 60 lbs. and one of estimated weight of 80 lbs. Length of this fish is given as 5′-3″ with a girth of 3′-6″. Calculated by the usual formula the weight was 148 lbs.

Some Shikar! The bag made by a party of guns in the Terai in 1870. 7th to 23rd April is worth recording.

18 tigers.
27 buffaloes.
135 deer.
42 pigs, &c., 240 head in all.

Old Magazines : Reference is made to some old sporting magazines, *viz.* :

Stocqueler's Bengal Sporting Magazine,
Hume's India Sporting Review, 1847,
Bombay Sporting Magazine,

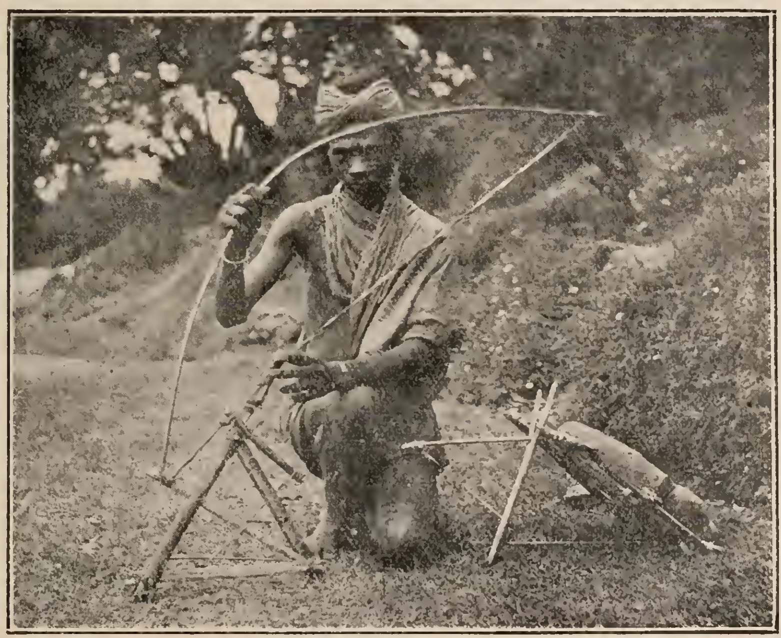
and it would be of interest to collate from these, and also from the Old Series of the Oriental Sporting Magazine (circulated 1824). The writer hopes to be able to do this at some future time.

R. W. BURTON, Lt.-Col.,
Indian Army.

Bombay, 12*th April* 1918.

No. XXXIII.—NILGIRI TRAP FOR CATCHING WILD ANIMALS.

The man in the photograph with the trap is an Irula, one of the jungle tribes found on the lower slopes of the Hills in S. India. This particular one comes from below Kil Kotagiri in the Nilgiris. He made these traps himself of bamboo : the size shown is for small game : such as hares and jungle-fowl. They can be made large enough, I am told, for animals as big as a tiger : at least the fall trap is used for them. Curiously enough this tribe has no weapons for hunting : such as bows and arrows nor slings.



PHILIP GOSSE, Capt., R.A.M.C.

Poona, 27*th July* 1918.

No. XXXIV.—*ELEOCHARIS CONGESTA*, DON., IN THE BOMBAY PRESIDENCY.

On the 6th October 1918 while working the marshes below Devarayi Station on the M. S. M. Railway, I came across the above sedge. This is new to the Presidency and was not included in my account of the Bombay *Cyperaceæ*, the second instalment of which (including the genus *Eleocharis*) is included in this Number. This sedge is common on the Nilgiri Hills. Its occurrence, as well as the occurrence of *Kyllinga melanosperma*, Nees, (*vide* p. 700 of the last Number), shows that the marshes in the forest regions of North Kanara and South Belgaum are suited to the sedges of the higher Southern Mountains, and further species may be expected in the future. In the clavis to *Eleocharis* this species follows *E. chætaria*, and its description is as follows :—

" Tufted, 4-8 inches, stems striate. Uppermost sheath truncate with a small subulate projection from just below the top. Spikelet one, inclined, usually proliferous and viviparous, about ¼ inch, ovate, acute, dark. Bristles dirty white or pale brown, as long as, or longer than the nut. Style 3-fid ; base very large.

Rare. Marshes on the crest of the Southern Ghats."

Another of the rarer Bombay sedges which I found in the same marsh is *Fimbristylis acuminata*, Vahl.

L. J. SEDGWICK.

DHARWAR, *October* 1918.

PROCEEDINGS

OF THE MEETING HELD ON 16TH APRIL 1918.

A meeting of members and their friends of the Bombay Natural History Society took place on Tuesday, the 16th April 1918, Mr. John Wallace presiding.

The election of the following 23 new members since the last meeting was announced :—Mr. Amir A. Ali, Mahboobnagar, Nizam's Dominions; Mr. E. C. Thatcher, Sahuspur P. O., Dehra Dun District; Mrs. G. A. Wathen, Amritsar; Mr. C. Norman, Rangoon; Mr. Duncan Cameron, Khaur, Pindigheb; Capt. S. T Sheppard, Bombay; Mr. A. J. H. Tietkens, Darjeeling; Mr. J. Fernandes, Pachmari; Mr. C. H. Langmore, Lopchu, Bengal; Dr. M. V. Mehta, M R C.P., L.M. & S., Bombay; Mr. L. G. Khare, B.A. (Cantab.), Bombay; Capt. E. A. H. Mackenzie, Jask; Mr. A. E. Donaldson, Rangoon; Mr. C. H. Q. McConnell, Ceylon; Mr. James Erskine, Ceylon; 2nd Lt. G. H. E. Hopkins, Bangalore; Mr. D. P. Frenchman, B.A., B.Sc., Bombay; Lt. J. Stuart Harrison, Secunderabad; Lt. Donald Lowndes, Wellington; Mr. B. W. Drury, Chanda, C.P.; Mr. D. F. Sanders, Hyderabad, Deccan; Mr. J. W. K. Fellowes, Satara; and Dr. A. J. Kohiyar, Bombay.

The following contributions to the Museum were received since the last meeting :—

Contribution.	Locality.	Donor.
1 Persian Gazelle (alive) (*Gazella* sp.)	Shustar, Persia ..	Major F. M. Bailey, C.I.E.
2 Persian Gazelle skulls..		
1 Sind Ibex (*Capara hircus*)		
41 Birds' skins		
2 Porcupines (*Hystrix* sp.)	Mesopotamia. ..	Capt. C. R. Pitman.
1 Hare (*Lepus* sp.) ..		
2 Gazelles (*Gazella* sp.) skulls and masks.		
62 Birds' skins		
1 Large Indian Civet (*V. zibetha*).	Sikkim ..	Mr. C. H. Dracott.
1 Spotted Tiger Civet (*P. pardicolor*).		
2 Sikkim Water Shrews (*N. sikkimensis*).		
15 Bats	Assam	„ C Primrose.
2 Pigmy Shrews (*Pachyura peroteti*).	Basrah	Sir Percy Cox.
2 Snakes		
1 Flying Squirrel (*Petaurista* sp.)	Garhwal ..	Mr. A. E. Osmaston.
1 Small Flying Squirrel (*H. belone*).	Sandoway ..	„ F. C. Purkis.
1 Bengal Porcupine (*H. bengalensis*) skeleton.	Chittagong ..	„ F. Boxwell.
1 Indian Wild Dog (*C. dukhunensis*).	Chittore.. ..	„ C. E. C. Fischer.

Contribution.	Locality.	Donor.
1 Small Indian Civet (*V. malaccensis*).	Nilgiris	Mr. J. Harding Pascoe.
1 European Bustard (*O. tarda*) ..	Qizil Robat, Mesopotamia.	Lt.-Genl. Sir R. Egerton.
31 Birds' skins	Mesopotamia ..	Lt. R. E. Cheesman.
1 Close-barred Sandgrouse (*P. lichtensteini*).	Muscat	Capt. C. W. Sanders.
1 Barn Owl (*S. flammea*) ..	Do.	Do.
1 Arabian Viper (*E. coloratus*)		
Scorpions, Insects, etc. ..		
1 Rook (*Corvus frugilegus*) ..	Mesopotamia ..	Capt. R. Hobkirk.
1 Water-Rail (*R. aquaticus*) ..		
2 Great Indian Bustards (*E. edwardsi*).	Dwarka	Mr. W. D. Cumming.
10 Snakes and a few Scorpions ..	Muscat	Maj. C Gharpurey.
12 Snakes	Siam	Dr. Malcolm Smith.
1 Hardwicke's Tortoise (*T. hardwickei*) (alive).	Wano	Capt. W. B. Cotton.

Minor contributions :—Mr. H. A. Fyzee, Mrs. Deakin, Dr. Row, T. W. Forster, J. A. Duke, and A. M. Kinloch.

OF THE MEETING HELD ON 30TH JULY 1918.

An ' At Home ' of members of the Bombay Natural History Society took place on Tuesday, the 30th July 1918.

The election of the following 36 members since the last meeting was announced :—Mr. H. W. Joynson, Nakon Lampang ; Dr. S. R. Machave, L.C.P. & S., Bombay ; Mr. R. W. Scaldwell, Hassan ; Kumari Shri Bakuverba of Gondal ; Major J. E. Hughes, Bombay ; Mr. F. G. A. Macaulay, Madras ; Col. W. J. Beyts, R.A.M.C., Bombay ; Mr. Philip Watson, Rangoon ; Capt. D. MacLachlan, I.A.R.O., Panjgur ; Mr. H. Dawson, Chitoor ; The Principal, Muir Central College, Allahabad ; Mr. C. M. Wise, Bombay ; Capt. D. H. Coats, R.A.M.C., Karachi ; Mr. L. S. White, Cawnpore ; The Junagadh Durbar, Junagadh ; Mr. B. H. Hayes, Meiktila ; Lt. A. D. McDonough, Cawnpore ; Mr. H. Donaldson, Bombay ; Capt. E. R. S. Dodds, I.A., Bombay ; Capt. N. L. Angelo, Mesopotamia ; The Principal. Dow Hill, Training College, Kurseong ; Mr. T. A. Martin, Penang ; Capt. Kumar Amar Singh, Delhi ; Mr. T. B. Hawkins, Bombay ; Mr. D. E. Gomme, I.A.R.O., Calcutta ; Lt. P. S. Humm, Dagshai ; Capt. R. Hobkirk, Mesopotamia ; Major C. C. Crosthwaite, I.A., Bannu ; Major A. Marshall, D.S.O., Quetta ; Col. G. C. Ogilvie, R.E., Quetta ; Mr. Lal Ram Pratap Singh, B.A., LL.B., Dehra Dun ; Miss B. Wooldridge, Bombay ; Mr. B. A. Fernandes, Bandra ; Mr. G. Wrangham-Hardy, Darjeeling ; Capt. G. H. deC. Martin, Mesopotamia ; and Miss Mabel E. Dibell, Madras.

The following contributions to the Museum were received since the last meeting :—

Contribution.	Locality.	Donor.
319 Mammals	Mekran	Capt. J. E. B. Hotson.
62 Birds' skins		
Snakes and Botanical Specimens.		
1 Serow skin and skull	Simia, Upper Burma.	Mr. P. M. R. Leonard.
6 Indian and Burmese Wild Dogs (*C. dukhunensis* and *rutilans*).		
5 Five-striped squirrels (*C. quinquestriatus*).		
2 Golden Cats (*F. temmincki*)		
1 Jungle Cat (*F. chaus*)	Mesopotamia	Mr. F. Ludlow.
2 Hares (*Lepus* sp.)		
3 Birds		
2 Leopard Cats (*F. bengalensis*)	Tibet	Mr. Rose Mayor.
1 Cat Bear (*A. fulgens*)		
1 Tibetan Fox (*V. ferrilatus*)		
1 Flying Squirrel (*Trogopterus* sp.).		
1 Marmot (*Arctomys himalayanus*).		
1 Lynx (*F. lynx*) skull	Sikkim	Mr. C. H. Draoott.
6 Eggs of Coromant (*P. carbo*)		
17 Butterflies		
1 Blackbuck (*A. cervicapra*) ♀ with horns.	Jaipur	Capt. Amar Singh.
1 Chinkara (*J. bencetti*) pale var.		
1 Hyæna (*H. striata*)	Nushki	Capt. J. G. Drummond.
1 Fox (*Vulpes* sp.)		
Four horned Antelope (*T. quadricornis*) mask.	Bhopal	Major J. W. Watson, I.M.S.
1 Sambhar (*C. affinis*) malformed skull.	Bundi	Mr. E. H. Waterfield.
1 Himalayan Civet (*P. grayi*).	Garhwal	Mr. A. E. Osmaston.
1 ,, Flying Squirrel. (*Petaurista* sp.)		
1 Jungle Cat (*F. chaus*)	Mesopotamia	Genl. H. Mackay.
1 Impala (*Aepyceros melampus*) skull.	Athi, B. E. Africa.	Lt.-Col. C. F. Dobbs.
1 Syrian Hedgehog (*E. calligoni*).	Mesopotamia	Capt. W. M. Logan Home.
1 Hedgehog (*C. micropterus*)	Deesa	Capt. J. Kane.
8 Mammals 2 Birds in spirit.	Karachi	Capt. C. B. Ticehurst, R.A.M.C.
1 Flamingo (*P. roseus*)		
2 Fishes		
2 Lizards		

Contribution.	Locality.	Donor.
2 Bats	Mesopotamia	Lt.-Col. F. P. Connor, I.M.S.
2 Snakes		
1 Skink		
A few Scorpions, Centipedes, Crabs and Insects.		
101 Birds' skins	Various	Mr. C. M. Inglis.
34 ,, ,,	Mesopotamia	Sir P. Z. Cox.
22 ,, ,,	,,	Capt. E. Robinson.
22 ,, ,,	,,	,, C. R. Pitman.
12 Birds	Garhwal	Col. A. Hooton, I.M.S.
1 Flying Squirrel (*Petaurista albiventer*).		
3 Birds' skins	Mesopotamia	Col. Grafton Young.
12 ,, ,,	Andheri & Khim..	Mr. S. H. Prater.
1 Mute Swan *C. olor*	Kurna	Capt. A T. Wilson.
1 Stiff-tailed Duck (*E. leucocephala*).	Mesopotamia	,, R. Hobkirk.
1 Indian Hobby (*F. severus*)	Lebong	Mr. E. A. Wernicke.
31 Birds' eggs	Sikkim	Capt. Aldworth.
21 ,, ,,	Mesopotamia	
4 Birds' eggs	,,	Major W. H. Lane.
2 Snakes		
14 Birds' eggs	Naga Hills	Mr. J. P. Mills.
1 Fish	Mesopotamia	Capt. Mackenzie.
4 Snakes		
6 Lizards		
5 Snakes	Shiraz	Lt.-Col. Condon.
3 Scorpions		
5 Large Water Cockroaches		
1 Snake (*Psammophis condonarus*).	Champaran	Mr. P. Broucke.
1 Sea Snake (*H. ornata*)	Jask	Major K. G. Gharpurey, I.M.S.
220 Butterflies	Sikkim	Major L. F. Bodkin.
30 ,,	Mussoorie	Mr. G. O. Allen, I.C.S.
2 Boxes of Insects	Mesopotamia	Lt. Harrison.
9 Butterflies and Botanical Specimens	Mt. Juplo and Mesopotamia.	Lt. F. Kingdon Ward.
Botanical Specimens	,,	Corpl. H. Whitehead.

Minor contributions from :—Mr. Kyrle Fellowes, Major Watney, Mrs. Deakin, Mr. D. F. Lobo, Mr. Hannyngton, Mr. Mitchell, Major Shaw, and Mr. Bailey-de-Castro.

OF THE MEETING HELD ON 24TH SEPTEMBER 1918.

A meeting of members and their friends took place on Tuesday, the 24th September 1918. Lt.-Col. H. J. Walton, I.M.S., C.M.Z.S., presiding.

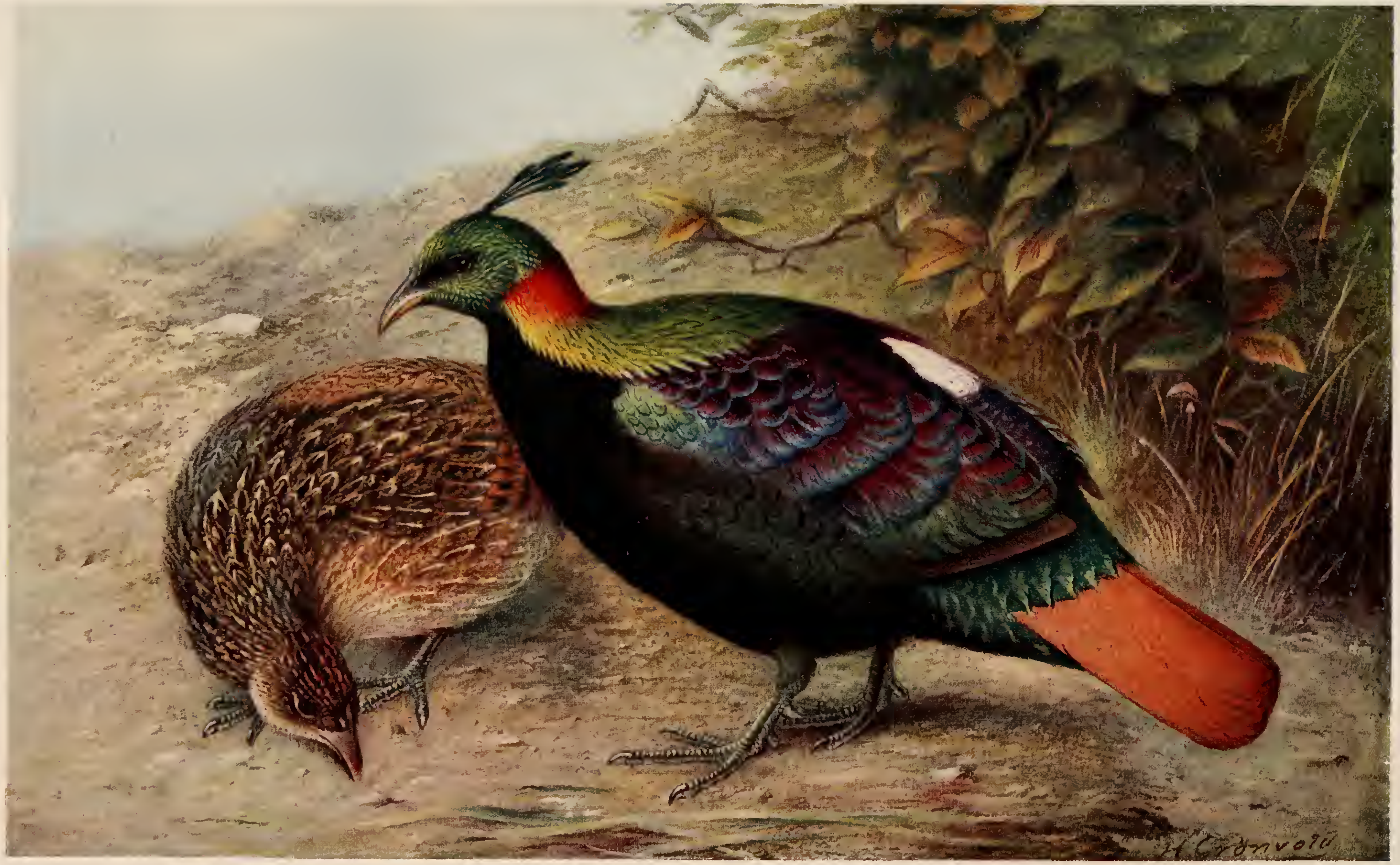
The election of the following 27 members since the last meeting was announced :—Capt. F. B. Blackie, Mesopotamia ; Major A. F. M. Slater, I.A., Fort Shabkadr; Major J. P. Bowen, R.E., Bombay; Major P. B. Bramley, I.A.R., Mesopotamia; Mr. H. B. Tilden, F.C.S. (London), Bombay; Capt. B. A. Rudkin, Mesopotamia; Mr. A. M. Heron, B.Sc., A.M.I.C.E., F.C.S., Tavoy; Major-General A. Skeen, Simla; Mr. J. F. R. D'Almeida, B.A., B.Sc. (Honorary), Bandra; Mr. G. H. Davey, Alleppey; Lt. H. J. Tebbutt, Bombay; Mr. T. S. Sabnis, B.A., B.Sc., Bombay; Major S. Percy, R.A., Mesopotamia; Lt. H. N. Irwin, M. C., Kurseong; Mr. R. F. Ruttledge, Ambala; Mr. A. W. Woodcock, Bombay; Lt. G. P. Lidiard James, Calcutta; Mr T. D. Wood, Calcutta; Mr. G. H. L. Mackenzie, Calcutta; Mr. J. E. A. den Doop, Medan, Sumatra; Lt. W. L. Stampe, Egypt; Mrs. F. E. Jackson, Tura; Dr. Ahlquist, Tura; Capt. J. A. Robinson, Bombay; Mr. F. G. Kennedy, Bombay; Mr. G. P. Duckworth, Poona; and Mr. A. M. Clarke, Bombay.

The following contribution to the Museum were received since the last meeting :—

Contribution.	Locality.	Donor.
South Indian Palm Civet (*P. jerdoni*).	Nilgiris	Mr. A. K. Weld Downing.
1 Southern Tree Mouse (*V. dumeticola*).	Ceylon	Mr. J. W. B. Goodfellow.
6 Small Mammals Skins and Skulls.	,, ...	Colombo Museum.
1 Burmese Wild Dog (*C. rutilans*).	Simia, U. Burma ..	Mr. P. M. R. Leonard.
1 Chinese Ant Eater (*M. crassicaudata*).		
5 Five-striped Squirrels (*C. quinquestriatus*), and a few Hemiptera.		
2 Black-shafted Ternlets (*Sterna saundersi*).	Karachi	Capt. C. B. Ticehurst, R.A.M.C.
2 Flamingoes (*P. roseus*) ..		
2 Collared Pratincoles (*Glareola pratincola*)		
1 Wood Snipe (*G. nemoricola*)	Mandalay ..	Mr. C. W. Allan.
4 Silk Moths (*A. royeli*) ..		
1 Black Partridge (*F. francolinus*)	Jalpaiguri ..	Mr. C. M. Inglis.
1 Eastern Weaver Bird (*Pl. phillipensis*).		
2 Birds	Mesopotamia ..	Capt. Hobkirk.
11 ,, ...	Bhyander ..	Lt. H. J. Tebbutt.
5 ,, ...	,, .	Lt. A. P. Kinloch.
Several Birds' eggs	Euphrates Marshes.	Mr. C. R. Watkins, I.C S.
7 Snakes	Tura, Garo Hills ..	Mrs. Jackson.
1 Desert Racer (*Z. rhodorachis*) ..	Bushire	Major H. R. Watson.
7 Lizards	Muscat	Major K. G. Gharpurey, I.M.S.
4 Scorpions		
A few Insects		

Contribution.	Locality.	Donor.
1 Indian Monitor (*V. bengalensis*) ..	Chanda	Civil Surgeon.
1 Cobra (*N. tripudians*) alive ..	Bombay	Lt. A. P. Kinloch.
1 Brown Tree Snake (*D. trigonata*)	Trevandrum ..	Capt. E. W. Antram.
1 Diamond-backed Racer (*Z. diadema*).	Attock	Attock Oil Coy.
1 Snake (*Z. rhodorachis*) .. 1 Giant Cricket	Mesopotamia ..	Major E. Arthur.
1 Spider (*Galeodes* sp.)	Suez	Mr. H. R. Rishworth.
1 Large Eel (*Murœna* sp.)	Bombay Harbour..	Mr. W. S. Hoseason.

Minor contributions :—Messrs. Lidiard James, P. M. R. Leonard, G. M. Wise and W. S. Millard.



MENPES PRESS, WATFORD.

LOPHOPHORUS REFULGENS.

The Monal Pheasant.

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

JOURNAL

OF THE

Bombay Natural History Society.

May 1919. Vol. XXVI. No. 2.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U.

Part XXVI.

With a Coloured Plate.

(*Continued from page* 18 *of Volume XXVI.*)

Genus—*LOPHOPHORUS.*

The genus *Lophophorus* contains but three species as it is now generally accepted that the bird hitherto known as the Bronze-backed Monal is merely a freak variety of the common form.

The three known species differ very widely from one another and each might well be placed in a genus by itself.

Lophophorus impejanus has a crest of long feathers spatulate at the end and with the shafts webless over five-sixths of their length. The tail consists of 18 feathers, well graduated and with the ends terminating in points as shewn in the wood-cut. The upper tail coverts are short, very stiff and end in points as do the tail feathers.

Lophophorus sclateri has the crest composed of short curly feathers in a dense mass over the anterior crown ; the naked part of the face is more extended, and the tail is composed of 20 tail feathers and is much less graduated, whilst the tips are square, not pointed. The upper tail coverts are soft, full and long and either square or gently rounded at the tips. If placed in a separate genus this bird would be known as *Chalcophasis*, Elliott.

Lophophorus l'huysii has the crest composed of ordinary feathers, long, narrow and slightly lanceolate. The tail appears to be composed of 22 feathers and the upper tail coverts are very long, coming to within an inch and a half of the tip of the tail feathers. In character these feathers are intermediate between those of *L. impejanus* and *L. sclateri*, metallic and not so full or soft as in the latter but rounded, not brought to a point, and less stiff than in the former.

As at present constituted, including all three birds, the genus is distinguished by the magnificent metallic plumage of the males. The bill is long, greatly curved and with the maxilla much overlapping the mandible. The tarsi and feet are very powerful and heavy, the former feathered above and with a strong though short spur. The face is more or less naked and highly coloured ; the wings much rounded, the first quill the shortest and the fifth and sixth sub-equal and longest. The tail is decidedly shorter than the wing and only slightly rounded.

The birds of this genus range over an area commencing in the West in South-Eastern Afghanistan and extending to the extreme East of Assam and the Mishmi and Abor Hills and North and East as far as the Koko Nor.

KEY TO SPECIES.

A. Most of the upper plumage metallic.
  a. Crest composed of feathers with naked shafts and spatulate ends. Tail rufous tipped darker ..... *L. impejanus* ♂
  b. Crest composed of short curly feathers. Tail black at the base, then chestnut with a wide terminal band white .... *L. sclateri* ♂
  c. Crest of long, slightly anceolate feathers. Tail metallic green with some white spots ...... *L. l'huysii* ♂
B. Upper plumage a mixture of buff, brown and rufous buff, never metallic.
  d. Lower back buff barred with black.. *L. impejanus* ♀
  e. Lower back and rump pale earthy white with narrow bars of brown. *L. sclateri* ♀
  f. Lower back white .... *L. l'huysii* ♀

LOPHOPHORUS IMPEJANUS.

The Impeyan Pheasant or Monal.

Impeyan Pheasant, Lath, Gen. Syn. Suppl. i., p. 208, pl. 114 (1787) (Hindoostan).

Phasianus impejanus, Lath, Ind. Orn. ii., p. 632 (1790) (India).

Phasianus curvirostris, Shaw, Mus. Lever. p. 101, pl. (1792) (India).

Lophophorus refulgens, Temm, Pig. et Gall. ii., p. 355 (1813) (Hindoostan); id. iii, p. 673 (1815) (India); Stephen in Shaw's Gen. Zool. xi., p. 249, pl. 15 (1819) (Hindoostan); Ogilvie-Grant, Cat. Birds B. M. xxii., p. 278 (1893) ; id., Handb.

Game Birds i, p. 231(1895); Blanford, Faun. Brit. Ind., Birds iv., p. 96 (1898); Rothschild, Ibis (1899); p. 441; id., Bull. B. O. C. viii. p. 42 (1899) x. p. 79 (1900); Fulton, J. Bomb. N. H. Soc. xvi, p. 61 (1904) (Lower Chitral); Walton, Ibis (1906) p. 247 (Chumbi Valley, S. Tibet); Ward, J. Bom. N. H. Soc. xvii., p. 944 (1907) (Cashmere); Magrath, J. Bomb. N. H. Soc. xviii, p. 298 (1908) (Thandiani, Hazara Dist.); Whitehead, Ibis (1909) p. 268 (Safed Koh, 9,000 feet), Finn, Avicult. Mag. (3) 1, p. 130 (1909); Magrath, J. Bomb. N. H. Soc. xix., p. 156 (1909) (Murree); Perreau, J. Bomb. N. H. Soc. xix., p. 920 (1910) (Chitral); Whitehead, J. Bomb. N. H. Soc. xx., p. 968 (1911) (Safed Koh); Bailey, J. Bomb. N. H. Soc. xxi, pp. 178, 182 (1911) (Chumbi Valley).

Impeyanus refulgens, Lesson Trate d'Orn. p. 488, pl. 85 (1831).

Lophophorus impeyanus, Gould, Cent. B. Himal., pls. 60, 61 (1832); Vigne, P. Z. S., (1841), p. 6 (Cashmere and Himalayah); Hutton, J. As. Soc. Beng. xvii., pt. 2, p. 695 (1848); Blyth, Cat. Mus. Asiat. Soc., p. 246 (1849); Gould, B. Asia vii, p. 53 (1850); Adams, P. Z. S. (1859) p. 185 (Cashmere); Irby, Ibis (1861) p. 235(Kumaon); Jerdon, B. Ind. iii, p. 51 (1863); Tytler, Ibis (1868) pp. 191, 194, 203 (Simla to Mussooree); Pelxeln, Ibis (1868) p. 320 (Koteghur); Beavan, Ibis (1868) p. 379 (Simla, add Sikkim); Elliot, Monog. Phasian. i, pl. 18 (1872); Pelzeln, Ibis (1873) p. 120; Hume, Nest and Eggs, Ind. B., p. 520 (1873); Brook's Str. Feath. iii., pp. 227, 256 (1875) (Mussooree and Gangootri Hills); Wilson, Str. Feath. iv., p. 227 (1876) (Derallee); Marshall, Birds Nests Ind. B., p. 59 (1877); Hume and Marshall, Game B. Ind. 1, p. 125, pl. (1878); Scully, Str. Feath. viii., pp. 342, 368 (1879) (Nepal); Marshall, Str. Feath. ix., p. 203 (1880) (Kurram, Afghanistan); Wardlaw-Ramsay, Ibis (1880), p. 70 (Safed Koh); Oates ed. Hume's Nests and Eggs iii., p. 407 (1890); Ogilvie-Grant, Cat. Birds B. M. xxii., p. 280 (1893): id. Hand. Game B. 1, p. 237 (1893) : Oates, Man. Game B. Ind. i, p. 262 (1898): Blanf. Faun. Brit. Ind. Birds iv., p. 97 (1898); Davidson, Ibis (1898) p. 38 (Cashmere); Rothschild, Ibis (1899) p. 441; Rodon, J. Bomb. N. H. Soc. xii, p. 573 (1899); Oates, Cat. Eggs Brit. Mus. i, p. 52 (1901); Seth-Smith, Avicult. Mag. vii, p. 160 (1909); St. Quintin Avicult. Mag. (3) iii, p. 150 (1911); Beebe, Pheasants, vol. i, p. 112 (1819).

Lophophorus chambanus, Marshall, Ibis, 1884, p. 421, pl. x. (Birnota Forest, Chamba); Oates, Man. Game. B. Ind. i, p. 267 (1898).

Lophophorus impeyanus mantoni, Oustalet, Bull, Soc. Zool. France xvii, p. 19 (1893); Ogilvie-Grant, Handb. Game B. i, p. 236 (1893); Rothschild, Ibis, (1899) p. 441; id., Bull. B. O. C. viii. p. 42 (1899), x. p. 79 (1900).

Lophophorus impeyanus obscurus. Oustalet, Bull. Soc. Zool. France xviii, p. 19 (1893); Ogilvie-Grant, Handb. Game B. i, p. 236 (1893); Rothschild, Ibis, (1899); p. 441; id., Bull. B. O. C. viii, p. 42 (1899).

Laphophorus ipejanus, Rothschild, Bull. B. O. C. xxxvii, pp. 49, 51 (1917).

Vernacular Names.—Lorst ♂, Ham ♀; Nil-mohr, Jungli-mohr (*Kashmere*); Nilgur (*Chamber*); Munal, Nil, ♂, Karari, ♀, (*Kulu*); Munal, Ghar-munal, Ratea Kawan, Ratnal, Ratkap (*N. W. Himalayas*); Datiya (*Kumaon* and *Garhwal*); Dafia (*Nepal*); Fo-dong (*Lepcha*); Cham-dong (*Bhotea, Sikkim*); Chadang (*Tibetan, Chambi Valley*).

Description—Adult Male.—Head and long crest of spatulate feathers brilliant metallic green; a patch of deep metallic purple behind the ear coverts; the lores and a streak behind the eye nearly bare; sides of neck and nape fiery copper-bronze changing gradually into bronze-green on the upper back; interscapulars, scapulars and wing coverts next the back, innermost secondaries and rump purple, not quite so lustrous as the upper back and with the innermost secondaries tipped metallic blue-green ; shoulder of wing and coverts furthest from the back much the same colour as the head. Primaries deep brown ; outer secondaries brown slightly glossed with green on the edge of the outer webs. Lower back white, sometimes pure, sometimes with fine black shaft stripes ; rump and shorter tail coverts purple more or less glossed with blue-green ; longest tail coverts metallic green like the wing.

Tail cinnamon, darker at tip.

Under parts brownish-black or dull black, varying considerably in depth and glossed with metallic green on the breast and flanks ; under tail coverts metallic green with dark bases.

The extent of metallic colouring on the lower parts varies greatly and in birds in plumage at all worn is practically non-existant whilst in some freshly moulted birds it is well developed.

A few specimens have the feathers of the rump edged with copper ; the extent of the white on the back varies considerably, and in the specimens first described was absent altogether.

Variations in tone, tint and depth of colouring are common and aberrant colouration by no means rare as was shewn by Lord Rothschild in his wonderful picture exhibited at the British Ornithologists' Club on May 9th, 1917. In the series of skins then shewn with this picture included the most extraordinary aberrations, one bird having a black tail, another the breast and lower parts wholly metallic, a third with the interscapulum blue instead of purple and so on. Semi-albino and melanistic varieties are not rare and specimens of these are to be found in the British Museum collection as well as in the Tring Museum.

Colours of the Soft Parts.—Irides hazel-brown or dark brown ; orbital skin and cheeks bright, smalt blue to brilliant ultramarine blue, or according to Hume, turquoise blue ; bill horny-brown, the culmen, tip and commissure paler yellowish-horny, in some specimens nearly the whole bill being of this colour ; lower mandible pale yellowish-horny or horny-grey ; legs yellowish or pale brownish-green, sometimes darker brownish and rarely yellowish-leaden colour ; toes darker and claws dark-horny brown.

Measurements.—Omitting two very small birds with a wing of only 9·7″ (246·3 mm.), these birds are remarkably level in size as is shewn by the following measurements, which are those of a very large series. Wing from 11·4″ (289·5 mm.) to 12·4″ (319·9 mm.), average 50 birds 11·7″ (297·1 mm.), tail from 8·4″ (215 mm.) to 9·25″ (235 mm.) ; tarsus about 3″ (76·2 mm.); crest about 3″ (76·2 mm.), sometimes up to 3·5″ (88·9 mm.) ; bill at front about 2·05″ (52 mm.) and from gape about 2·2″ (55 mm.).

"Weight, about 5 lbs." (F. M. Bailey).

Adult Female.—Feathers of head, with short crest of lanceolate feathers black with broad central stripes and narrow edges of rufous buff; feathers of nape the same but with broader more spatulate striæ; back and mantle black, each feather with two buff streaks and narrow buff edges, a feather here and there shewing white instead of buff markings, this giving a curiously mottled appearance; feathers of lower back buff with crescentic bars of black; tail coverts the same but the black increasing in extent so as to finally occupy most of the surface; longest tail coverts whitish at the tips; tail boldly barred black and rufous and tipped white.

Visible portion of the wing covert and inner secondaries like the back but the feathers more mottled and less regularly marked with black; primaries and outer secondaries dark brown, the former sometimes mottled with rufous buff on the outer web, the latter more or less barred with the same.

Below chin, throat and foreneck white; remainder of lower parts brown, the feathers of the breast and flanks regularly marked with buff lines following the contour of the feathers; abdomen and lower breast the same but with the bars much more broken and irregular and sometimes obsolete, their place being taken by indefinite pale central streaks; shafts white; lower tail coverts white barred with rufous and black in varying degree.

The range of tints on the lower surface is considerable, some birds appearing almost black on these parts, others, quite a rufescent buff.

Colours of the Soft Parts.—Similar to those in the male but duller; the bill is paler, the dark portion being confined to the base and nostrils.

Measurements.—Wing 10·2″ (259 mm.) to 11·3″ (287 mm.); average 10·7″ (271·7 mm.); tail from 7″ (177·2 mm.) to 8·05″ (205·0 mm.); tarsus about 2·8″ (68·5 mm.); crest 1·3″ (33·0 mm.); bill at front about 2″ (50·8 mm.), and from gape about 2·1″ (53·3 mm.).

"Weight, 4-lbs. 11-ozs." (F. M. Bailey.)

The young male is like the female but has the throat much mottled with black; the upper parts generally have more black and less rufous and therefore appear darker as a whole, and the under parts are much more boldly mottled and barred with black and rufous with broad white central marks breaking up the latter.

The Chick in its first plumage is like the female but has the plumage above marked with conspicuously broad central streaks of white; below the throat and fore neck are dull fulvous white and the abdomen and flanks buff feebly barred and blotched with dark brown.

Chicks in Down have the crown rufescent chestnut with a central line of black; nape brown, feebly mottled with paler; back chestnut brown with broad lateral streaks of buff; wing and tail quills pale cinnamon buff with blackish pencillings and broad pale central streaks to the inner secondaries; below dirty fulvous buff.

In the series in the British Museum although many birds are in a moulting stage there is nothing to support Mr. Wilson's theory of a colour change in the plumage taking place without a moult from the pied brown and buff to a metallic green or purple, indeed every moulting bird confirms the belief that this change is one entirely caused by actual moult.

Distribution.—Afghanistan, Chitral, and the Western Himalayas through Kashmir, Garhwal, Nepal, Sikkim, Native Sikkim, Bhutan of the Chambi Valley and South Tibet.

How far West this bird penetrates into Afghanistan is not yet known, but it does not seem to be found near Kabul, though it is very common in the Safed Koh Range and thence North-East through Kafirstan and Chitral. Its extreme Eastern limits appear to be Central Bhutan and, when living in Kamroop, a district of Assam South of Bhutan, I could never hear of its being found anywhere to the East of Dewangiri, though the Bhuteas knew the birds and sometimes obtained the skins from further West.

Nidification.—The Moonal breeds during May and June ; a few birds may begin to lay in the last week of April in the lower hills and, on the other hand, in the higher ranges eggs may be found as late as July. The earliest date I have recorded is the 1st of May 1910, and the latest is 26th June 1909, clutches of 5 and 4 eggs respectively taken by Mr. S. L. Whymper in Tehri Garhwal. It should be noted, however, that Whitehead found young birds fairly strong on the wing "on the 27th June" so that the eggs must sometimes be laid early in April.

They breed as low down as 8,000 feet and rarely even lower than this as there is a very old record of a nest having been found below Simla at about 7,500 feet ; most birds, however, breed above rather than under 10,000 feet and they may be found up to 14,000 and 15,000 feet during the breeding season.

They invariably lay their eggs in forest but it is not imperative that this should be of the densest. Mr. Whymper, who has taken many nests of this Pheasant in Garhwal, informs me that—

> "The majority of nests, if one may use such a term, are to be "found in forest consisting of big trees but not with very thick "undergrowth, indeed I have more than once taken them in "places where the growth was so light one could walk in "comfort except for the fact that the ground was much broken. "The nest is a mere scratching in the earth, generally hollowed "out by the bird itself, under the shelter of a big bush, the "bole of some large forest tree or, perhaps, a rock. As far as "I have seen there is no attempt made to form a nest in this "hollow. Where the trees are deciduous and many leaves "have fallen these naturally collect in any hollow and thus "form a bed for the eggs, but in evergreen forest, such as forms "the usual habitat of the Moonal, the hollow is often quite "unlined except for a few casual leaves and a few odd feathers "fallen from the bird itself. I have never taken more than

"five eggs in a clutch but have known birds to incubate on "three or four only, and clutches of four or five eggs are about "equally common.

"The hen bird sits very close and when disturbed from the "nest generally sneaks quietly away on foot. I have not noticed "males in the vicinity of the nest and cannot say whether "he takes any interest in the young when hatched."

"Mountaineer"—(Mr. F. Wilson) gives a description of the breeding habits which agrees very closely with the above and expresses his doubt as to the occurrence of clutches of eggs of eight or nine as alleged by some sportsmen and others. Major Cock, not always very accurate in oological details, mentions clutches of the Moonal as varying from five to eight, whilst Hutton found clutches of three and four only. Beebe found a hen sitting on two eggs considerably advanced in incubation and says that sets of two eggs are by no means unknown. He also speaks of eight eggs in a set as perfectly authenticated, but does not quote his authority.

In captivity all game birds nearly will lay a very much greater number of eggs than they do in a wild state. Thus I have known an Impeyan lay sixteen eggs, a Crossoptilon lay thirty-two, and so on, consequently the number of eggs laid by a bird in confinement is no criterion of the number of eggs we might expect in a state of nature. The only exception appears to be the Polyplectron which invariably lays only two when caged, though she may rarely lay four or five in her own forest home.

At the present day I know of no place where Moonal are so numerous that, as described by Hume "several nests may be found within a circle of a hundred yards as if the females were, even at this season (as they are at all others), more or less gregarious." In certain parts of Garhwal, Kashmir and Chitral they are still common, but one would have to work hard and cover much ground to find more than two or three nests in a day.

The eggs, as noted by Hume remind one much of Turkeys' eggs, though normally they are more richly and much more profusely marked.

In ground colour they vary from a very pale dirty buffy white to a rather warm cafe-au-lait, never of at all a rich hue. The markings consist of specks, spots and freckles of reddish-brown distributed thickly all over the surface of the egg, but often in a denser ring round the centre of it. Some eggs have a few blotches in addition to the spots and freckles, though these are seldom of any size, and in a few the blotches are more numerous and bigger and the freckles more sparse, so that the eggs have a handsome boldly marked appearance. One clutch of four in the collection of Mr. Whymper is a very handsome one, the ground colour a pale bright buff, whilst the blotches are particularly large and richly coloured, the speckles being practically absent.

The majority of eggs are rather long in shape and fairly compressed at the smaller end, a few are very long and narrow and here and there is one but little compressed. I have seen no egg which could be described as a broad oval.

The surface is fine and close, but there is very little or no gloss, and the shell, for the size of the egg, is not very strong.

The average size of 52 eggs is 64·7 × 44·3 mm., whilst of those which have passed through my hands the longest and broadest measure respectively 69·8 × 44·8 mm., and 62·6 × 48·8 mm. The shortest and most narrow are 59·6 + 45·3 mm., and 61·0 × 41·6 mm. Beebe records the narrowest egg as 43 mm. only.

The period of incubation varies from 26 to 29 days, but is generally 27.

Wilson ("Mountaineer") says that the cock bird takes no interest in the hen, eggs or young once the pairing season is over and the eggs laid, and this want of marital and paternal affection seems to be confirmed by modern observers. Before, however, the breeding season is in full swing the male becomes most assiduous in his attentions to his prospective bride, and his courting displays have frequently been described. Major Rodon gives an excellent description of the nuptial dance and his remarks thereon are worth careful attention.

> "When shooting in the Himalayas this April I noticed early "one morning, while sitting behind a tree, a pair of Moonal "Pheasants feeding a short distance from me, on a flat terrace "on the open hillside. They were so close that I was able to see "their every movement distinctly. After being busily engaged "some time in their usual digging operations, the hen bird "stopped work and uttered her call note several times, upon which "the cock, who was at the time some little distance away, ran "up to her with his wings raised high above the back, tail spread "and neck and body feathers distended. He then moved "quickly to and fro for a few seconds in front of the hen, who "stood quietly looking on at his performance; he then abruptly "closed his wings and tail, turned about and ran back to his "feeding ground while the hen went on with her breakfast. As "the early morning sun was shining on the birds, the sudden "appearance of the cock in the above performance was most "splendid to look upon, the beautiful metallic hues of the wings "and throat, with the pure white of the back and the chestnut "coloured tail, spread like a fan behind, shone out most gorge-"ously. I believe in all courting displays among birds of fine-"coloured plumage, the hen takes a most passive part, and does "not in any way call the performance up; but the male birds "themselves of their own accord go through the ceremony of "shewing off their fine feathers in front of their lady loves. But "in this case the lady, by her calls, appear to have directly

"invited or encouraged the display as the lover was digging out "his breakfast until he heard the call sounded."

General habits.—The Moonal is essentially a bird of high elevations, ascending and descending the mountains practically with the snow line though throughout the winter months many birds, more especially the males, remain where the snow lies more or less thickly. They are not found, however, above forest or thick bush jungle, such as rhododendron, though for feeding purposes they may be met with in the mornings and evenings wandering about the grassy slopes considerably higher up than these limits. They live, however, in the forests and directly they are disturbed seek their cover.

Roughly speaking in summer they are generally to be obtained between 10,000 and 14,000 feet, provided the country is suitable, but they wander up considerably higher than this, and have also been recorded from much lower. At one time they were really *very* common all round Mussoorie and the adjoining hills at an elevation of about 9,000 feet, and as already noted, were found breeding below Simla, down to a height of some 7,500 feet.

In winter they descend to 6,000 and even 5,000 feet and Perreau found them common at the latter height in Chitral. Hume also remarks that during particularly bad weather they are sometimes driven down as low as 4,500 feet at which elevation his people occasionally killed them.

With constant persecution the birds have of late years moved further and further away from civilization and although in some parts from Kashmir and Garhwal to Sikkim they are still common; they have left many of their old haunts and where in "Mountaineer's" day they were obtained in hundreds, the occurrence of odd specimens and pairs is all that can now be hoped for.

In a letter to me Mr. H. Stevens tells me that they are still very common in many parts of native Sikkim, but they are much more rare now all round Darjiling itself though they are still to be found if one knows where to look—at no great distance from that charming Hill Station. Mr. S. L. Whymper found them common in many of the higher, well-wooded valleys of Garhwal, and they are equally so in some of the less frequented parts of Kashmir. In this State also under the fostering care of Col. Ward and the Maharajah they undoubtedly have become more numerous of late years.

Mr. C. H. Donald in some notes kindly sent me from Simla writes thus of Moonal at the present day:—

"The Moonal is still found in the Chor, throughout the Jubal "and Taroche States in suitable localities. In the Bushahr "State—on the right bank of the Sutlej River,—they are fairly "numerous throughout the portion known as the Pundrabis Range, "*i.e.*, from the Kulu-Bushahr border almost up to the Rogi on the "Hindustan-Tibet Road, but get scarce towards Rogi on the

> "left bank from Kilba to Baghi, they are most common in the "centre of the State and are not often met with on the upper "reaches of the Sutlej watershed. There are always a few in "the environments of Narkandah and Baghi and get more "numerous as you get further East up to about 100 miles from "Simla and then get more scarce again and appear to die out "entirely in the rainless portion of Kanaur.
>
> "Between 8,000 feet and 12,000 feet altitude is where they are "usually found, throughout the Kulu and Kangra Hills, including "the Mandi and Suket States into Chamba and Kashmir.
>
> "Practically from Garhwal to Kashmir in the Punjab, the "Moonal is still fairly common and in spite of the numbers that "are annually trapped in the hawking-nets their numbers do not "appear to have fallen to any appreciable extent. They may "have left the environments of big stations but are numerous "enough further afield."

I am afraid that there is no doubt that in the case of this bird the plumage trade has been to a very great extent the cause of its rapid decrease. Where the trade is properly organized and the female, young and eggs efficiently protected, the plumage of the males may be exported in great numbers without any harm being done. Thus Wilson year after year exported the skins of 1,000 to 1,500 males without there being any decrease in the forests where he worked, but it must be remembered in these he never allowed the killing of hens and throughout the breeding season all interference with the birds was entirely tabooed. The modern dealer does not, however, work on these lines. He knows nothing and cares less about the natural history of the bird, the skins pass through many hands before they reach the dealer on the London market, and the native, who in the first place supplies them, only collects with a view to immediate profit and without thought to the future ; consequently he collects largely in the early part of the breeding season, kills as many females—often sitting—for food as he does males for their plumage, and so harasses the birds that they cannot hatch off their eggs when laid. It is true that most birds which are *trapped* are trapped in the winter, but the nooses catch hens, cocks and immature birds alike and none are spared.

The traps used are similar to those which have already been described as used by various hill people for other game birds, the favourite being the setting of nooses in openings in small artificial fences in ground the birds frequent for feeding.

During the winter they seem to be more or less gregarious, two or three hens with their respective forces combining to make one flock. Sometimes an adult cock may take up his quarters with them, but as a rule three or four old males consort together during the non-breeding season.

Wilson describes this pheasant as being tame for a game-bird, and notes that where it is most common it is most confiding and, *vice-versa*, where most rare there it is most wild and difficult of approach; nor is this because where most common it is least hunted and interfered with for such is far from being the case.

As a sole object for sport the Moonal can in our day hardly suffice to satisfy sportsmen unless they are of that kind who are content with a long day's tramp over the most beautiful country with but a moderate bag at the end of it, varied by days which are almost blank. To such the never-ending interest of the grand and wild scenery and magnificent mountains and forests loved by these noble birds in itself suffices, and if in the course of one's climbs two or three of them fall to the gun, well, so much the added joy to the day's outing. Even now, however, if the would-be sportsman will wander far enough away from civilization, cultivation and the beaten track, he may yet get bags of a dozen or even more birds in a single day's shoot. Where they are fairly common they do not appear to be hard to obtain and they have not the same notorious reputation for running instead of flying as is the case with so many of our Indian Game-Birds. They rise fairly well when disturbed and generally fly some distance before again alighting; sometimes, however, when flushed they take to the trees and in such cases allow the sportsman to get quite near enough for a shot before they again take to wing. As might be expected of so big a bird they rise with considerable fluster in addition to which they utter at the same time loud shrill whistles repeated whilst on the wing until they are in full flight.

Bailey found them very common in the Chambi Valley up to the tree limit, there somewhere about 14,000 feet elevation. He writes :—

"They have a habit of whistling in the early morning, and at "this time it is easy to walk through the thick forest towards "the sound and shoot them sitting. I found that the following "was the best way to get sporting shots; two guns would walk "quietly along the road and two men would go quietly through "the forest alone, these men whistled if they saw any Moonal "and then put them up when they would sail down-hill over "our heads."

As regards their diet, there has been but little added to Wilson's notes as quoted by Hume to the following effect :—

"In autumn the Moonal feeds chiefly on a grub or maggot "which it finds under the decayed leaves; at other times on "roots, leaves and young shoots of various shrubs and grasses, "acorns, and other seeds and berries. In winter it often feeds "in the wheat and barley fields; but does not touch the grain; "roots and maggots seems to be its sole inducement for digging "amongst it. At all times and in all seasons, it is very assiduous "in the operation of digging and continues at it for hours "together. In the higher forests, large open plots occur quite "free from trees and underwood, and early in the morning, or "towards evening, these may be seen dotted over with Moonals, "all busily engaged at their favourite occupation."

Beebe thus describes a view he obtained of these gorgeous pheasants feeding in one of these open glades :—

"In the high forests of Garhwal and Kashmir I have watched "these pheasants at their communal feeding places and found "every movement full of interest. At about 10,000 feet, in the "still quiet of mid-day, I once came across a level shelf of long "grass shut in by low spruces and deodars. The little glade was "some dozen yards across, and part of it appeared to have been "recently ploughed. Closer inspection shewed abundant recent "sign and some stray Impeyan feathers. The birds had evidently been working here for some time and I prepared a blind "a little distance away in a tree, from which I could see almost "all the glade. The following morning a heavy downpour held "steadily until daylight, but the succeeding night was clear, "and before early dawn, lighted only by the faint greenish glow "from Halley's comet, I made my way from camp along the "summit of the ridge to my station. Here I shivered and shook "with cold for an hour or more until the first few sprinklings of "morning songs had grown into a well-filled chorus, with an "accompaniment of the two-phrased, reiterated song of a tiny "green warbler. A Koklass called far down the valley, and ten "minutes later my first Impeyan appeared, stepping quietly "out from the low trees and going at once to the edge of the "glade, where he appeared to be picking at the long blades of "grass.

"For fifteen minutes nothing more happened, and then, for "the space of an hour, Impeyans began to appear singly or in "pairs and once three together. Three other times I had been "grieviously disappointed while in hiding, and now it seemed as "if I was to succeed in my concealment. Fourteen birds, every "one a cock in full adult plumage, were now in sight. Most of "the birds went at once to the diggings, and, stepping down into "the hollows, began industriously to pick the earth away with "strong, sweeping flicks of their great shovel mandibles. Some "of the birds were in holes a foot deep, and when working, only "their brilliant backs were in view. They seldom worked more "than three or four seconds without raising their heads and "giving a swift glance around and especially *upward* into the "sky, and I imagine that the source of most of their troubles "lies in soaring eagles. There was no fighting but now and "then an undignified scramble for some tuber or other edible "morsel. One or two birds spent much of the time walking "slowly about on the outskirts of the glade, but there was no "systematic watch or sentinal duty, such as is well-known "among some species of birds. They were remarkably silent, "only now and then a subdued gutteral chuckle or a protesting "whistle as one was crowded. Instead of scattering promiscuously over the whole of the glade, they were concentrated "along the edges of the dug-over area, this being due probably "to a zone of more abundant food. When a large tuft of "grass or bamboo was encountered the birds dug around it "and under it until it was left supported by its bare roots, "or in one case until it actually toppled over. The sight of "more than a dozen Impeyans thus engaged was most "remarkable, and when the sun rose upon them the colour effect "was indescribable, fourteen heaving masses of blue, green, "violet and purple, and now and then a flash of white, set among "the green of the turf and the black of the newly disturbed loan. "It was surprising how seldom one caught a glimpse of the white "lower back. Only when some unusually violent effort made "the bird extend a wing to keep its balance, did the white gleam "forth."

The flesh of the Impeyan is fairly good eating though, naturally, old birds are tough and stringy and if one is forced to turn so grand a bird into a meal he should select a young one for the purpose.

LOPHOPHORUS SCLATERI.

Sclater's Moonal.

Lophophorus sclateri, Jerdon, Ibis, (1870), p. 147 (Mishmi Hills); Sclater, P. Z. S. (1870), p. 162, pl. xiv.; Elliot, Mong. Phas. i., pl. 20 (1872); Hume, Str. Feath. ii., p. 488 (1874) (E. Assam); Hume and Marshall, Game B. Ind. i., p. 13, pl. (1878) (Sadyia); Godw., Aust. P. Z. S. (1879), p. 681, pl. i. (Sadyia); Hume, Str. Feath. ix., pp. 198, 203 (1880) (Mishmi); id. xi., p. 301 (1888) (Mishmi); Ogilvie-Grant, Cat Birds B. M. xxii., p. 282 (1893); Hartert, Bull. B. O. C. iii., p. 12 (1893) (Mishmi); Ogilvie-Grant, Handb. Game B. i., p. 240 (1895); Oates, Man. Game Birds Ind. i, p. 269 (1898); F. M. Bailey, Jour. B. N. H. S. xxiv, p. 76 (1915); Rothschild, Bull. B. O. C. xxxvii, p. 50 (1917); Beebe, Pheasants, vol. i, p. 153 (1819).

Vernacular Names.—Dong (*Tibetan, Po Ba dialect*) Pui-di. (*Bhute tratta, mishmi*).

Description—Adult Male.—A tuft of feathers below the nostril and narrow lines of feathers from the upper corner to the crown black; crest of short, curly feathers metallic blue-green; ear coverts and narrow line behind the crest black with blue-green reflections; sides and back of neck copper with bronze-green reflections; whole mantle and upper back deep purple blue-green, mostly purple on the shoulders and blue-green elsewhere; lower back, rump and upper tail coverts white with a few black shaft stripes and, in one specimen, metallic white spots at the tips. Tail mottled black. rufous and white on the basal half, then rich chestnut rufous and finally a terminal white band.

Lesser and median wing coverts bronze-green shot with copper; greater coverts and inner secondaries deep metallic blue-green; primaries and outer secondaries velvety blue-black.

Below from chin to under-tail coverts deep velvety black.

Colours of Soft Parts.—"Iris dark brown; bill dirty white; legs pale greenish; bare orbital space, blue". (F. M. Bailey.)

"Bill yellowish-horny; forehead, lores and sides of the head bright blue, nearly naked; legs and feet yellowish-brown." (Ogilvie-Grant.)

"There is a large bare space all round the eye, which in the fresh bird, is bright blue, dotted with tiny tufts of black hair like feathers; the irides are brown; the legs and feet brown or yellowish-brown; the bill yellowish-horny." (Jerdon, *vide* Hume.)

Measurements.—"Total length 26″; wing 11·8; tail 8·2; tarsus 3·1″. (Ogilvie-Grant).

"Weight, 6¼ lbs." (F. M. Bailey). The weight of a fine cock weighed by Mr. J. Needham and myself in Sadiya was just over 6½ lbs. Three males in the British Museum collection measure as follows:—wing 292 mm. (a poor specimen in heavy moult) to 325 mm; tail (of two) 194 and 206 mm.; tarsus 78 to 82 mm. The longest of the thick curly feathers of the crest if pulled out straight measure an inch or over. Bill at front about 50· 4mm., and from gape about 55·8 mm. The short blunt spur measures from 12 to 18 mm.

Adult Female.—Upper part of head and whole neck rich vandyke-brown with a buff v-shaped mark on each feather; lores mottled white, fulvous and brown, the first colour predominating; sides of the head like the crown but paler; back, scapulars with some of the wing coverts next them, and innermost secondaries rich chocolate-brown with buff central streaks widening into ill-defined rufescent-buff bars on each feather; lower back, rump and upper tail coverts pale earthy white, more rufous near the back, more white on the longest tail coverts, irregularly barred with narrow wavy lines of brown; on the longest tail feathers the bars are bolder and almost black; tail black broadly tipped with white and with six or seven narrow bars of white; central tail feathers also mottled with rufous in the terminal half and all with a more or less mottled edge of buff and brown. Primaries umber-brown, outer secondaries the same but with the outer webs mottled on the margins like the tail; remainder of visible wing black with numerous bars of rich chestnut rufous and very fine buff shaft streaks.

Below, chin and throat white; remainder of lower plumage dull brown densely covered with tiny wavy bars of dull ochre.

Colours of Soft Parts.—Irides brown; bill pale yellow-green, or horny-green, legs (not seen until the bird had been dead over 24 hours) dull pale greenish–lead colour.

Measurements.—Wing 279·4 mm., tail 192·8 mm.; tarsus 71·1 mm.; bill at front about 48 mm., and from gape about 50·0 mm. There is a short crest about 18 mm. in length.

Distribution.—As far as we know at present Sclater's Moonal is a bird of very restricted habitat. It is found only in the Hills North of the Assam Valley from the extreme Eastern Dafla Hills to the East of the Abor and Mishmi Hills. How far North it extends we do not know, but it is undoubtedly found in Tibet North of the Hills mentioned as it was known to the Tibetants met with by some of the survey parties which were working N.-E. of the Dafla Hills after the Abor Expedition of 1901. On the other hand it is not likely to extend very far North-East as at Batong to Ta-chien-lu, over which country several persons have worked, it was never met with and at the latter place the next bird *L. l'huysii* was recorded as common. On the other hand Oates' prophecy that it would be found sooner or later in some of the Northern Burmese Hills has been fulfilled as Beebe met with it in North-Western Yunnan close to the Burmese Frontier.

General Habits.—There is at present nothing on record about these fine pheasants beyond the fact that they are supposed to haunt the higher wooded hills of Eastern Assam. During the five years I lived in Dibrugarh and Sadiya I made the closest inquiries after it as Col. Chatterton and I hoped to combine the pleasure of shooting the Takin and *Lophophorus sclateri* in one trip. The natives assured us that this was quite possible and pointed out to us certain peaks and ranges about 9,000 feet high to which both bird and mammal resorted in winter, the nearest of which ranges being within 24 hours work of the Plains and our furthest military out-post. At this time, however, the frontier was in a very disturbed state and our trip fell through. Later on after I had left the district Col. Chatterton was sent up with a military expedition and did actually come across both Takin and Sclaters Moonal quite close to one another. The latter were in very dense forest at an elevation of about 10,000 feet, the undergrowth being very thick except where broken up by rocks. Where the birds were the trees were principally oak and rhododendron, but there were also stretches of the most magnificent pine trees and here and there open spaces on the steep mountain-sides covered with short, thick grass and bracken or moss and lichen covered slabs of grey rock.

At the time Col. Chatterton came across them several birds were together, apparently young and two or three old hens but no cock bird. They were very shy and though they allowed a comparatively close approach they kept out of sight and shot so that except for a few brief glimpses they escaped observation and none were brought to bag.

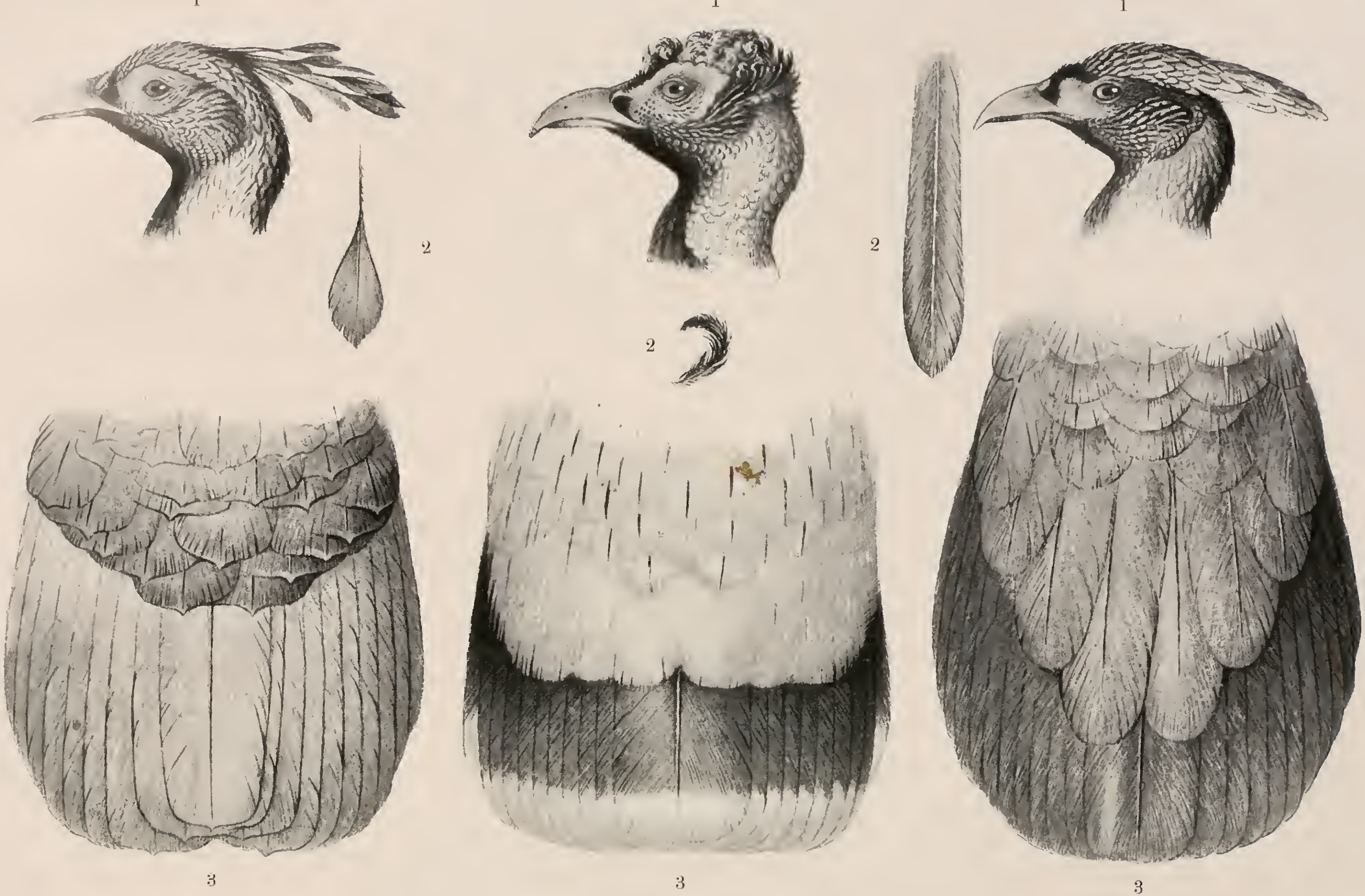
Unfortunately the expedition, a very small one, were in rather a tight corner and it was impossible to follow up the birds to any distance from camp, but the sentries on duty in the one special spot reported that the birds returned there with the greatest regularity morning and evening, and could be heard scratching about and feeding in the undergrowth like a flock of barn-door fowls.

The Abors say that they are birds of the highest elevations, being found all the year through close to the snows or actually beyond the snow-line. Certainly the few birds brought in whilst I was in Assam all came from some distance within the hill ranges and it was only in the severest winters they came down to 7 or 8,000 feet. Normally, if what we were told was true, they very seldom come below 9,000 feet and in summer frequent the ranges at 12,000 to 15,000 feet.

The Mishmis say that they are "fool-birds" and very easy to trap, and that they are very good to eat.

Beebe, one of the few white men who have seen this pheasant, describes his meeting with it in the following words:—

> "I had hardly crept five yards from the place of my ugly "adventure when two feathers caught my eye and straight way "I forgot my fears. They were from the plumage of no silver "pheasant, but brilliant, irridescent, changeable green and purple. "I was at a loss to know from what gallinaceous bird they had "come. A little way further I found another. Later while "worming my way through a barking deer's tunnel at the root "of a perfect tangle of bamboo, I heard the subdued chuckles "and the rustling of leaves ahead. A few feet brought me to a "deeply worn but steep sambhur trail, along which I made my "way on hands and knees, without making a sound.
>
> "The rustling of leaves, and the spray of earthen pellets "falling down, came more distinctly to my ears, and at last I "rested for many minutes with my face buried in a clump of "blue, sweet-scented pea-flowers.
>
> "Inch by inch I then edged myself upward, digging with "fingers and toes into every deepened hoof-rut. A shower of "earth fell upon me and with joy I saw that a clump of soft-"leaved mint-like plants lay before me. I did not have to "increase my numerous wounds by a slow penetration of either "nettles or briers.
>
> "The revelation came sooner than I expected. Noiselessly "plucking away leaves and stems one by one to form a low "tunnel I pushed slowly and cautiously ahead. . . . "Then the forms of one or two birds appeared, and with a "screen of leaves still intervening I watched what was probably "the first wild Sclater's Impeyan ever seen by a white man.



MONAL PHEASANTS.

Lophophorus impejanus. *Lophophorus sclateri.* *Lophophorus l'huysii.*

1. Heads showing variation in crests. 2. Single feathers of crest. 3. Tails and upper tail-coverts.

"An inch nearer, another leaf cleared away and I saw there "was but one bird.

"It was a splendid male, digging vigorously and almost continuously with its beak, working round in a circle so that I "saw it turn its breast, sides and back. I watched it for five "minutes, when it turned, without apparent cause, but not from "fright, and disappeared into the low marshy tangle behind.

"As quietly as I could lift my arm and pull up my gun from "where it was dragging behind me, I fired at the still moving "stems, and listened for some hint of the effect. Not a sound "came forth.

"I clambered up to where the bird had stood, rushed into the "underbrush and almost stepped upon the pheasant as it lay "six feet from the opening. As I leaned down trembling with "excitement, two living bombs burst from the ground a few "feet away,—a pair of hens or young males—and in a fraction "of a second were out of sight."

Unfortunately Beebe, in spite of his long description of many pages, does not say at what height he found these pheasants, but as he mentions the fact that he continuously passed through wild bananas during his hunt for them it must have been at a comparatively low level, and his whole account of the country would shew it to be of a nature consistent only with tropical humid forests under rather than over 5,000 feet.

Capt. F. M. Bailey met with this pheasant on the upper Dibang Valley. He writes:—

"Common in the upper Dibang Valley and on both sides of "the Yong Yap-La. Cocks weighed 5 lbs. in May. It is very "noisy in the evenings. These birds when chased by a dog refused "to fly until nearly caught when they would fly into a tree and "remain there while the dog barked below. Our dog actually "caught one. They were mostly found in small flocks of two or "three individuals. Po Me Monal Pheasants are found, though "no specimens were collected. It appears that both *L. sclateri* "and another similar bird with a crest of long feathers are found "together. This is probably *L. l'huysii* but possibly *L.* "*refulgens* and is called *Tse* by the Pobas. Monal Pheasants "were also seen on the Se La and other places near Tawang, "but no specimens collected."

LOPHOPHORUS L'HUYSII.

Lophophorus l'huysii, Verreaux and St. Hiliare, Bull. Soc. Acclim. (2) iii, p. 223, pl.; (1866) (Moupin); id., iv., p. 706 (1867); Sclater, P. Z. S., (1868), p. i., pl. i.; id. Ibis, (1870), p. 297 (Tatsienlu); Grey, Handl. Birdsii., p. 261 (1870); Swinhoe, P. Z. S.; (1871), p. 399; David, Nouv. Arch. Mus. de Paris, vii., (1871) p. ii; Elliot, Mong. Phas. i, pl. 19 (1872); Gould, B. Asia vii, p. 54 (1873);

Sclater, Ibis; (1874), p. 169; David and Oustalet, Ois. Chine, p. 40, pl. 110 (1877) (Moupin, and W. Szechuen); Sclater, P. Z. S., (1891), p. 212 (Szechuen); Seebohm, Ibis, (1891), p. 379; Pratt, "To the Snows of Tibet" (1892), p. 202; Ogilvie Grant, Cat. Birds B. M. xxii., p. 281 (1893); id. Handb, Game B. 1, p. 238 (1895); Rothschild, Bull. B. O. C. xxxvii, pp. 49-51 (1917); Beebe, Pheasants, vol. i, p. 148 (1819).

Vernacular Names.—Pæ-mou-ky, Ho-than-ki, Hwa-than-chi (*Chinese*); Koo aloong (*Tibetan*).

Description—Adult Male.—Forehead and a narrow line running down to each nostril and ending in a thick tuft at the angle of the lores velvety black; crown and sides of the head metallic green with crimson-bronze reflections in some lights; crest fiery purple-bronze with blue reflections on the shortest feathers; back and sides of the neck, and extreme upper back rich glistening copper with bronze-green reflections on some of the outer feathers; remainder of upper back and scapulars with the innermost visible secondaries purple mixed with blue-green; lower back and uppermost feathers of the rump white, the latter with terminal central striæ of metallic blue; remainder of rump metallic green-blue with terminal white edges to a portion of both webs, forming long shaped spots or semi-bars; tail coverts and visible portions of tail feathers the same but unspotted; concealed portions of tail feathers blackish with a few white spots on either web of all but the outermost pair.

Visible portion of the wing green-blue with purple reflections and the shoulder and lesser wing coverts next it shot with golden-bronze; primaries and concealed portions of secondaries dark brown.

Below black, many feathers especially on the upper breast, sides of the neck and upper flanks with irridescent green edges.

Colours of Soft Parts.—"Bill horn-colour; naked skin round the eye blue; legs and feet lead-colour". (Ogilvie-Grant.)

Measurements.—The measurements of three specimens in the British Museum collection are as follows;—

Wing 328 to 334 mm.; tail 263 to 283 mm.; tarsus 82 to 91 mm.; bill at front about 55 mm., and from gape about 58 mm.; crest about 65 mm.

Adult Female.—Very similar to the female of *impejanus* from which, however, it can be easily distinguished by its having the whole of the lower back and rump white. The shorter upper tail coverts are mottled brown and white, the longer brown barred with buff and a few faint white frecklings.

Colours of Soft Parts.—Similar to those in the male.

Measurements.—Wing 11·1″ (282 mm.); tail 9·7″ (245 mm.); tarsus 3″ (76·2 mm.); bill at front 2·05″ (52 mm); and from gape 2·2″ (55 mm.)

Distribution.—The North-Western ranges of Sze-chuen extending East and North into Tibet through Ta-chien-lu into the Koko-Nor. Although Père David believed it to occur in Yunnan and Queichow, nothing has as yet been ascertained to corroborate this belief, reasonable though it appears to be.

Nidification.—Nothing recorded.

General Habits.—Père David's excellent account of this grand pheasant's habits is still the only one in existence. He writes :—

> "This magnificent Lophophorus inhabits the highest ranges "of Moupin, the Eastern Kokonoor and the Western frontiers "of Setchuan. It goes about in small parties in the open grass "lands above the region of the forests, but returns to the trees "to roost and sleep. Its constant food consists of vegetable "substances and principally of succulent roots which he digs "out very cleverly with his powerful and broad edged bill; "as he searches especially for those of a yellow Fritillaria "called *Pae-mou*, the people of the country have given him "the name of *Pae mou-ky*. In this country they also call it "*Ho-than-ky* (the fowl of burning charcoal) the male adult, "splendid in his metallic plumage. It is a very foolish bird "whose flight is very powerful. His cry to which he gives "vent in the very early morning and when it is about to "rain, consists of three or four piercing and well-divided "notes."

From some information which I have received, *Lophophorus l'huysii* should also be found in Yunnan and Kowytcheon; it is certain, in any case, that one meets with it in a great portion of Eastern Tibet, but it is rare everywhere, and it will not be long before it disappears altogether. The Chinese constantly hunt this superb fowl and use every means to collect it as the flesh is very delicate. The specimens which I have sent to the Natural History Museum, South Kensington, were killed at an elevation of 4,500 metres.

(*To be continued.*)

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY

OF THE

BOMBAY NATURAL HISTORY SOCIETY.

(By R. C. Wroughton.)

Part III.

(*Continued from page* 58 *of Volume XXVI.*)

Family IV.—Canidæ.

Blanford arranges the three genera of the Canidæ in a key as follows :—

Key to the genera of the Canidæ.

A.—A frontal sinus present; postorbital process smooth and convex above; tail, including hair at the end, less than half the length of the head and body.	
a. Seven teeth in lower molar series ...	I. Canis.
b. Six teeth in lower molar series ...	II. Cuon.
B.—No frontal sinus; postorbital process concave above; tail more than half the length of the head and body ...	III. Vulpes.

Gen. I.—Canis.

No. 67. *lupus*, L.
No. 68. *pallipes*, Sykes.

There seems no doubt that Hodgson's name of *laniger* for the Thibetan wolf is better than *lupus*.

No. 69. *aureus*, L.

I dealt with this name, and its derivation, in 1912 (J. B. N. H. S. xxi, p. 837). The absence of any representative of true *aureus* makes it impossible to deal with this question authoritatively. However, as all the probabilities are in favour of such a course, and no inconvenience is likely to ensue, I decided to treat the Indian jackal under Hodgson's name *indicus*. More recently, when examining our Indian material in detail, I was confirmed in the adoption of this course, and led to establish a subspecies *kola*, for the Dekhan jackal, and two species, *naria* and *lanka*, for the South Indian and Ceylon forms respectively. (J. B. N. H. S. xxiv, p. 649, 1916).

Key to the species of Canis.

A.—Size large, head and body 3 ft. long or more.

- *a.* Larger, head and body about 3 ft. 6 inches long; much woolly underfur. . 1. *laniger*, Hodgs.
- *b.* Smaller, head and body about 3 ft. long; little or no woolly underfur ... 2. *pallipes*, Sykes.

B.—Head and body 2 ft. to 2 ft. 6 inches long.

- *a.* General pattern variegated, *i. e.*, a pale ground colour irregularly splashed with black.
  - *a*¹. Darker, ground colour "ochraceous buff," limbs "tawny" ... ... 3. *indicus indicus*, Hodgs.
  - *b*¹. Paler, ground colour "buff" or even "cream buff," limbs "ochraceous buff" ... ... 4. *indicus kola*, Wr.
- *b.* General pattern grizzled, *i. e.*, ground colour black, ticked with white.
  - *a*¹. Larger, head and body 765 mm, hind foot, 161 mm; third upper premolar with a supplementary median-internal rooted lobe ... 5. *lanka*, Wr.
  - *b*¹. Smaller, head and body 670 mm., hindfoot, 140 mm.; no supplementary lobe on third upper premolar ... ... 6. *naria*, Wr.

Distribution :—

1. *C. laniger*, Hodgson.	*Type locality* :—Probably Thibet. *Other localities* :—Thibet (B. M.). *Type* :—Missing. (Type of *C. niger*, Scl., Ind. Mus. Calc. No. ?).
2. *C. pallipes*, Sykes.	*Type locality* :—"Dukhun." *Other localities* :—Karachi, Sind; Rajputana (B. M.); Cutch; Kathiawar; Hazaribagh (M. S. I.) *Type* :—B. M. No. 42. 8. 6. 2.
3. *C. indicus indicus*, Hodgson.	*Type locality* :—Nepal. (Hodgson). *Other localities* :—Mussoorie (B. M.); Kumaon; Bengal; Orissa; Sikkim; Bhutan Duars; Chin Hills; Chindwin; Shan States; Mt. Popa (M. S. I.). *Type* :—B. M. No. 43. 1. 12. 29.

4. *C. indicus kola*, Wroughton.

Type locality :—Palanpur, Guzerath (B. N. H. S.—Crump).

Other localities :—Rajputana ; Sehore, Central India ; Hoshangabad, Central Provinces ; Dekhan (Sykes) (B. M.) ; Cutch ; Kathiawar ; Khandesh ; Nimar ; Central Provinces ; Gwalior ; Sind (M. S. I.)

Type :—B. M. No. 16. 4. 16. 12.

5. *C. lanka*, Wroughton.

Type locality :—Mankeni, Eastern Province, Ceylon.

Other localities :—"Ceylon" (B. M.); Asugam Bay, E. P., Ceylon (M. S. I.)

Type :—B. M. No. 16. 4. 16. 21.

6. *C. naria*, Wroughton.

Type locality :—Coorg. (B. N. H. S.—Shortridge).

Other localities :— Konkan ; North Kanara ; North Malabar (B. M.) ; Koyna Valley ; Dharwar ; Mysore ; (M. S. I.)

Type :—B. M. No. 16. 4. 16. 31.

Gen. II.—CUON.

No. 70. *dukhunensis*, Sykes.
No. 71. *rutilans*, Müll.

There seems to be no change needed in the names in this genus. Blanford distinguishes the two species as follows :—

Key to the species of CUON.

A.—Larger and stouter ; hair long, with woolly underfur ; ferruginous red to tawny ; hindfoot over 175 mm. 1. *dukhunensis*, Sykes.
B.—Smaller and slighter ; hair short, no underfur ; bright ferruginous ; hindfoot, 150 mm. ... ... 2. *rutilans*, Müller.

DISTRIBUTION :—

1. *C. dukhunensis*, Sykes.

Type locality :—"Dukhun."

Other localities :—Kashmir ; Rajputana ; Kanara ; Madras (Jerdon) ; Nilgiri Hills ; Sikkim ; Darjiling (B. M.) ; Berars ; Nimar ; Central Provinces ; Kumaon; Coorg (M. S. I.).

Type :—B. M. No. 79. 11. 21. 634. (Type of *primævus*, Hodgs. B. M. No. 43. 1. 12. 28).

2. *C. rutilans*, Müller. *Type locality*:—"Bengal."

Other localities:—S. W. Siam; Malay Peninsula (B. M.); Mt. Popa (M. S. I.).

Type:—Unknown.

Gen. III.—VULPES.

No. 72. *bengalensis*, Shaw.
No. 73. *cana*, Blanf.
No. 74. *leucopus*, Blyth.
No. 75. *alopex*, L.
No. 76. *ferrilatus*, Hodgs.

Except for the substitution of the name *montana*, Pearson, for *alopex*, L., a European species, (J. B. N. H. S. xxiii, p. 291, 1914), there seems no reason at present to make any change in Blanford's names. His key is as follows;—

Key to the species of VULPES.

A.—Tip of tail black; ears grey outside.
  a. Larger, skull length about 150 mm.; rufous grey ... . 1. *bengalensis*, Shaw.
  b. Smaller, skull length about 90 mm.; ashy grey ... ... 2. *cana*, Blanf.
B.—Tip of tail white.
  a. Ears black or dull brown outside.
    *a*¹. Small, hindfoot 100-120 mm. ... 3. *leucopus*, Blyth.
    *b*². Large, hindfoot 150 mm. ... 4. *montana*, Pears.
  b. Ears pale rufous outside; size small . 5. *ferrilatus*, Hodgs.

DISTRIBUTION:—

1. *V. bengalensis*, Shaw. *Type locality*:—"Bengal."

Other localities:—Khairpur and Thar and Parkar, Sind; Sambhar, Rajputana; Delhi; Sehore, Central India (B.M.); Sind Frontier; Cutch; Kathiawar; Palanpur State; Khandesh; Central Provinces; Dharwar; Kumaon; Bengal; Sikkim (M. S. I.).

Type:—Unknown. (Type of *chrysurus*, Gray, B. M. No. 37. 6. 10. 48 Type of *kokree*, Sykes, B. M. No. 42. 8. 6. 3; Type of *indicus*, Hodgs., B. M., No. 43.1.12.116)

2. *V. cana*, Blanford.

Type locality:—Gwadar, Baluchistan.

Other localities:—Kandahar; Bajaor, N. W. Frontier (Whitehead) (B. M.). Not obtained by Survey.

Type:—B. M. No. 78. 4. 23. 1.

3. *V. leucopus*, Blyth.

Type locality:—"Desert of Western India."

Other localities:—Sind; Punjab; Jodhpur, Rajputana (B. M.); Sukkur. Sind; Bhuj, Cutch (M. S. I.).

Type:—Ind. Mus. Calc. No. m. (Type of *pusillus*, Blyth. Ind. Mus. Calc. No. l.; Type of *persicus*, Blanford, Ind. Mus. Calc. No. *v*.; Type of *griffithi*, Blyth, Ind. Mus. Calc. No. *w*.).

4. *V. montana*, Pearson.

Type locality:—"Himalaya."

Other localities:—Gilgit; Simla. Punjab; Mussoorie.

Type:—Ind. Mus. Calc. No. d^2. (Type of *himalaicus*, Ogilby, B. M. No. 55. 12. 24. 237).

5. *V. ferrilatus*, Hodgson.

Type locality:—Lhassa, Thibet.

Other localities:—Nepal; Karo La, Thibet, 16,600′; Eastern Central Thibet (B. M.).

Type:—B. M. No. 45. 1. 8. 214.

Family V.—MUSTELIDÆ.

There are three Subfamilies which may be arranged in a key as follows:—

Key to the Subfamilies of the MUSTELIDÆ.

A.—Claws short, compressed, acute, curved, semiretractile; toes partially webbed; upper posterior molar of moderate size, transversely elongate... ... ... I. MUSTELINÆ.

B.—Claws blunt, not compressed, not retractile.

a. Foot elongate; toes not webbed; upper posterior molar, variable ... ... II. MELINÆ.

b. Foot short, rounded; toes webbed; upper posterior molar large and quadrate III. LUTRINÆ.

Subfamily I.—MUSTELINÆ.

The four genera in this Subfamily may be distinguished as follows:—

Key to the genera of the MUSTELINÆ.

A.—Premolars on each side, 4 above and below. I. MARTES.
B.—Premolars on each side, 3 above and below.
  a. Limbs and abdomen darker than back.
    *a*¹. Colour above fulvous ... ... II. PUTORIUS.
    *b*¹. Colour above blotched white and dark brown ... ... III. VORMELA.
  b. Lower surface not darker than upper... IV. MUSTELA.

Gen. I.—MARTES.

This genus, as now understood, corresponds to the MUSTELA of Blanford. Bonhote has separated the Burmese form under the sub-specific name *peninsularis* (A. M. N. H. (7) p. 346, 1901), and at the same time recognised the Madras form *gwatkinsi*, Horsf. as a distinct species. Hodgson gave the name *toufœus* to the Indian representative of the European *foina*. These four forms may be arranged in a key as follows:—

No. 77. *flavigula*, Bodd.
No. 78. *foina*, Erxl.

Key to the species of MARTES.

A.—Tail, without hair, three-fourths the length of head and body.
  a. Soles of feet hairy.
    *a*¹. Shoulders light coloured. ... 1. *f. flavigula*, Bodd.
    *b*¹. Shoulders dark brown ... ... 2. *gwatkinsi*, Horsf.
  b. Soles of feet naked ... ... 3. *f. peninsularis*. Bonh.
B.—Tail, without hair, half the length of the head and body ... ... 4. *toufœus*, Hodgs.

DISTRIBUTION:—

1. *M. flavigula flavigula*, Boddaert.

Type locality:—Nepal, Assam, &c.

Other localities:—Hazara; Kashmir; Kishtwar; Kumaon; Nepal; Sadya, Assam (B. M.); Kumaon; Sikkim; Bhutan Duars; Chin Hills; Chindwin (M. S. I.).

Type:—Unknown.

2. ***M.*** *gwatkinsi*, Horsfield.	*Type locality* :—"Madras" (?Dharwar). (Elliot). *Other localities* :—Coorg (M. S. I.). *Type* :—B. M. No. 79. 11. 21. 621.
3. *M. flavigula peninsularis*, Bonhote.	*Type locality* :—Bankasun, Tenasserim. (Hume-Davison). *Other localities* :—Tenasserim ; Malay Peninsula (B. M.); Tenasserim ; (M. S. I.). *Type* :—B. M. No. 85. 8. 1. 66.
4. *M. toufœus*, Hodgson.	*Type locality* :—Lhassa and Siling, Thibet. (Hodgson). *Other localities* :—Thibet, North of Sikkim (Mandelli) ; Ladauk (Strachey); Hazara (Whitehead) (B. M.). *Co-types* :—B. M. Nos. 45. 1. 8. 260 261 & 262. *Lectotype* :—B. M. No. 45. 1. 8. 262.

Gen. II.—PUTORIUS.

No. 79. *larvatus*, Hodgs.	It is somewhat doubtful whether this species ever crosses into our area from Thibet.
DISTRIBUTION :—	
P. larvatus, Hodgson.	*Type locality* :—Plain of Central Thibet (Hodgson). *Other localities* :—None. *Type* :—B. M. No. 58. 6. 24. 116. Skull No. 79. 11. 21. 203. (This is also the type of *thibetanus*, Horsf.).

Gen. III.—VORMELA.

This name, though established many years ago, was definitely accepted by Miller in 1912. (Cat. Mamm. W. Europe, p. 428).

No. 80. *sarmaticus*, Pall.	Miller, in 1910, accepted *peregusna* as an earlier name for this species (U. S. Nat. Mus. xxxviii, p. 385), the only one in the genus.
DISTRIBUTION :—	
V. peregusna, Güldenstadt.	*Type locality* :—Banks of the River Don, Southern Russia. *Other localities*:—Seistan ; Kandahar (Hutton) (B. M.). *Type* :—Unknown.

Gen. IV.—MUSTELA.

No. 81. *erminea*, L.
No. 82. *subhemachalana*, Hodgs.
No. 83. *canigula*, Hodgs.
No. 84. *alpinus*, Gebl.
No. 85. *kathiah*, Hodgs.
No. 86. *strigidorsa*, Hodgs.

The representative of the European stoat, *erminea*, is the species named *whiteheadi* by myself (J. B. N. H. S. xviii, p. 882, 1908), and similarly that of *alpinus* is *longstaffi*, described also by myself (J. B. N. H. S. xx, p. 931, 1911). The other species noted remain as used by Blanford. To meet these changes Blanford's key may be modified as follows:—

Key to the species of MUSTELA.

A.—Tail-tip dusky or black.
  a. Lower parts, white ... ... 1. *whiteheadi*, Wr.
  b. Lower parts, brown ... ... 2. *subhemachalana*, Hodgs.
B.—Tail-tip not darker.
  a. A pale median dorsal stripe... ... 3. *strigidorsa*, Gray.
  b. No dorsal stripe.
    *a*¹. Nose white ... ... 4. *canigula*, Hodgs.
    *b*¹. Nose the same colour as forehead.
      *a*². Size larger.
        *a*³. Colour above "clay colour" below buff... ... ... 5. *temon*, Hodgs.
        *b*³. Colour above "ècru drab", below white ... ... 6. *longstaffi*, Wr.
      *b*². Size smaller; colour dark brown. 7. *kathiah*, Hodgs.

DISTRIBUTION :—

1. *M. whiteheadi*, Wroughton.	*Type locality* :—Kagan, Hazara. (Whitehead). *Other localities* :—None. *Type* :—B. M. No. 8. 10. 3. 1.
2. *M. subhemachalana*, Hodgson.	*Type locality* :—Nepal. (Hodgson). *Other localities* :—Sikkim; Mogok, Upper Burma, 4,400′; (B. M.) Sikkim (M. S. I.). *Type* :—B. M. No. 43. 1. 12. 12. (Type of *humeralis*, Blyth, Ind. Mus. Calc. stuffed. No. c. (Darjiling); Type of *horsfieldi*, Gray, B. M. No. 42. 4. 29. 57. (Bhotan)).
3. *M. strigidorsa*, Gray.	*Type locality* :—Sikkim. *Other localities* :—Nepal (B. M.). Chin Hills. (M. S. I.). *Type* :—B. M. No. 53. 8. 16. 15.

4. *M. canigula*, Hodgson. *Type locality* :—Lhassa, Thibet.
Other localities :—Dharamsala, Punjab; Kashmir (B. M.)
Type :—B. M. No. 45. 1. 8. 253. (Type of *hodgsoni*, Gray, B. M. No. 41. 934.).

5. *M. temon*, Hodgson. *Type locality* :—Nepal (Hodgson).
Other localities :—Kumaon; Lachen, Sikkim (B. M.)
Co-types :—B. M. Nos. 58.6.24.115 and 79.11.21.447.
Lectotype :—B. M. No. 58.6.24.115.

6. *M. longstaffi*, Wroughton. *Type locality* :—Teza, Upper Sutlej Valley 14,000′ (Longstaff).
Other localities :—Ladak (Whitehead) (B. M.).
Type :—B. M. No. 10.12.2.1.

7. *M. kathiah*, Hodgson. *Type locality* :—Nepal (Hodgson).
Other localities :—Mussoorie; Sikkim, Bhutan (B. M.), Kumaon; Darjiling (M. S. I.).
Type :—B. M. No. 43.1.12.14.

Subfamily II.—MELINÆ.

Blanford distinguishes the three genera as follows :—

Key to the genera of the MELINÆ.

A.—Upper molar broader than long, not larger than upper sectorial.
  a. An external ear; colour paler below than above... ... ... I. HELICTIS.
  b. No external ear; colour pale above, black below ... ... II. MELLIVORA.
B.—Upper molar longer than broad, and larger than upper sectorial ... III. ARCTONYX.

Gen. I.—HELICTIS.

No. 87. *orientalis*, Horsf.
No. 88. *personata*, Geoff.

There is very little material available for examination and it seems almost doubtful to me whether these two forms are not one species. In any case *nipalensis*, Hodgs. must take the place of *orientalis*, Horsf. which is a Javan species. With this change, I think it will be most convenient to retain for the present Blanford's arrangement, which is as follows :—

Key to the species of HELICTIS.

A.—Colour brown or yellowish brown, not grey	1. *nipalensis*, Hodgs.
B.—Colour brownish grey.	2. *personata*, Geoff.

DISTRIBUTION :—

1. *H. nipalensis*, Hodgson.	*Type locality* :—Nepal. (Hodgson). *Other localities* : —Dilkoosha, Cachar (B. M.) *Type* :—B. M. No. 42. 1. 12. 27.
2. *H. personata*, Geoffroy.	*Type locality* :—Pegu. *Other localities* :—Manipur; Nan, Siam (B. M.); Mt. Popa (M. S. I.). *Type* :—Probably in Paris Museum.

Gen. II.—MELLIVORA.

No. 89. *indica*, Kerr.	The only species in the genus.

DISTRIBUTION :—

M. indica, Kerr.	*Type locality* :—" India." *Other localities* :—Rajputana; Central Provinces (B. M.). Cutch; Hazaribagh (M. S. I.). *Type* :—Unknown. (Type of *Ursitaxus inauritus*, Hodgson, B. M. No. 45. 1. 8. 251.)

Gen. III.—ARCTONYX.

No. 90. *collaris*, F. Cuv.
No. 91. *taxoides*, Bl.

I have been able to find no record of the rediscovery of *taxoides* since it was named by Blyth. Thomas has named a species *dictator*, (A. M. N. H., 8 V., p. 424, 1910) from S. W. Siam, just over the border from Tenasserim, which will almost certainly be found later within our limits, like so many other forms from Trong. These three forms may be distinguished as follows :—

Key to the species of ARCTONYX.

A.—Size large, greatest length of skull 166 mm.	1. *dictator*, Thos.
B.—Size small, greatest length of skull 135 mm., or less.	
a. Larger, greatest length of skull 135 mm.	2. *collaris*, F. Cuv.
b. Smaller, greatest length of skull less than 125 mm.	3. *taxoides*, Bl

DISTRIBUTION :—

1. *A. dictator*, Thomas.	*Type locality* :—Trong, S. W. Siam. (H. C. Robinson). *Other localities* :—None. *Type* :—B. M. No. 10. 4. 17. 1.
2. *A. collaris*, F. Cuvier.	*Type locality* :—Bhutan Duars. (Diard). *Other localities* :—Nepal; Lockaw, Karennee (B. M.) Chin Hills (M. S. I.), *Type* :—Perhaps in Paris Museum.
3. *A. taxoides*, Blyth.	*Type locality* :—Assam. (McClelland). *Other localities* :—None. *Type* :—Ind. Mus. Calc. No. a.

Subfamily III.—LUTRINÆ.

The two genera may be distinguished as follows :—

Key to the genera of the LUTRINÆ.

A.—Claws distinct, and well developed in all toes ... ... I. LUTRA.
B.—Claws small and rudimentary ... II. AONYX.

Gen. I.—LUTRA.

No. 92. *vulgaris*, Erxl.
No. 93. *ellioti*, And.
No. 94. *aurobrunnea*, Hodgs.

Blanford in an appendix (Mamm. p. 601) modified, in consequence of a paper by Thomas (P. Z. S., p. 190, 1889), his earlier arrangement of the Otters. He omitted entirely *aurobrunnea*, as being synonymous with *vulgaris*, and while retaining this latter name, he accepted *macrodus*, Gray, as being an older name, as a substitute for *ellioti*. But considerable changes, in even this revised arrangement, are necessary. The name *lutra*, L. is older than *vulgaris* and must be used for it. After careful examination of all the Museum material, Mr. Thomas agrees with me that the specimen which must be taken as the type of *tarayensis* is the same species as *macrodus*, (other specimens show that *monticola*, of which the actual type skin is lost, is also the same species). As the older name therefore *tarayensis* must take the place of *macrodus*, for the Smooth Indian Otter. These changes necessitate an alteration in Blanford's key of the genus, which may be made as follows :—

Key to the species of LUTRA.

A.—Upper margin of naked nose angulate in middle ; skull and teeth markedly smaller	1. *lutra*, L.
B.—Upper margin of naked nose straight ; skull and teeth markedly larger ...	2. *tarayensis*, Hodgs

DISTRIBUTION :—

1. *L. lutra*, Linnæus.	*Type locality* :—Upsala, Sweden. *Other localities* :—Kashmir ; Nepal ; "Madras" (Elliot) ; Travancore ; Ceylon (B. M.) Kumaon ; Sikkim ; Coorg ; Ceylon (M. S. I). *Type* :— Unknown.
2. *L. tarayensis*, Hodgson.	*Type locality* :—Terai, Nepal (Hodgson). *Other localities* :—Sind ; Rajputana ; Benares (B. M.) ; Sind ; Central Provinces ; Chin Hills ; Chindwin ; Sagaing, Upper Burma (M. S. I.). *Type* :—B. M. No. 43. 1. 12. 101. (Type of *monticola*, Hodgs. (skull only) B. M. No. 214. f. ; Co-types of *macrodus*, Gray, B. M. Nos. 46. 6. 13. 31. and 46. 11, 9. 11. ; Type of *ellioti*, And. Ind. Mus. Calc. No. m.)

Gen. II.—AONYX.

No. 95. *leptonyx*, Horsf. The name *cinerea*, Illig., is older than *leptonyx* (J.B.N.H.S. XXII. p. 503, 1913), and must therefore take its place. It is the only species in the genus.

DISTRIBUTION :—

A. cinerea, Illiger.	*Type locality* :—Batavia, Java. *Other localities* :—Nepal ; Bhutan ; Sadyia, Assam ; Madras (B.M.) ; Kumaon ; Chindwin ; Coorg (M.S.I.). *Type* :—Unknown. (Type of *indigitata*, Hodgson, B.M. No. 45.1.8. 369.).

Family VI.—PROCYONIDÆ.

There is only one genus in our fauna.

Gen.—AILURUS.

No. 96. *fulgens*, F, Cuv. The only species.

DISTRIBUTION :—

A. fulgens, F. Cuvier.

Type locality :—" Indes orientales."

Other localities :—Nepal (B.M). Sikkim (M.S.I).

Type :—Perhaps in Paris Museum. (Co-types of *ochraceus*, Hodgson, B.M. Nos. 43.1.12. 34 & 35. Lectotype 43.1.12.35.)

Family VII.—URSIDÆ.

The three included genera may be distinguished as follows :-

Key to the genera of the URSIDÆ.

A.	Upper incisors six.	
	a. Larger, length over 5 feet ...	I. URSUS.
	b. Smaller, length under 4 feet 6 inches	II. HELARCTOS.
B.	Upper incisors four	III. MELURSUS.

Gen. I.—URSUS.

No. 97. *arctus*, L.

No. 98. *torquatus*, Wagn.

Blanford includes *malayanus* in the genus URSUS, but that species is now generally recognised as belonging to a distinct genus HELARCTOS. The name *arctus*, L. applies to the north European bear; for its Indian representative *isabellinus*, Horsf., should be used. The two species included in the genus may be distinguished by their colour as follows ;—

Key to the species of URSUS.

A.	Colour brown...	1. *isabellinus*, Horsf.
B.	Colour black	2. *torquatus*, Wagn.

DISTRIBUTION :—

1. *U. isabellinus*, Horsfield.

Type locality :—Nepal (Hodgson).

Other localities :—Gilgit ; Kashmir (B.M.).

Type :—Not traced.

2. *U. torquatus,* Wagner. *Type locality* :—Hills of Nepal.

Other localities :—Kashmir; Nepal; Sikkim (B.M); Chin Hills (M.S.I).

Type:—Unknown. (Type of *pruinosus,* Blyth; Ind. Mus. Calc. No. *r*.)

Gen. II.—HELARCTOS.

This name was established by Horsfield in 1825 (Zool. Journ. II. p. 221), as a subgenus of URSUS, but is now generally accepted as a full genus.

No. 99. *malayanus,* Raff. The only species.

DISTRIBUTION :—

H. malayanus, Raffles. *Type locality* :—Sumatra (Raffles).

Other localities :—Malay Peninsula (B.M.). Chindwin; Shan States (M. S.I.).

Type :—Unknown.

Gen. III.—MELURSUS.

No. 100. *ursinus,* Shaw. The only species.

DISTRIBUTION :—

M. ursinus, Shaw. *Type locality* :—"Interior parts of Bengal."

Other localities :—"Madras" (Sykes) (B. M). Bengal; Coorg; Ceylon (M.S.I).

Type :—Unknown.

Order VI.—RODENTIA.

The RODENTIA are divided by Blanford into two Suborders which he distinguishes as follows :—

Key to the suborders of RODENTIA.

A. Two incisors in upper jaw ... ... I. SIMPLICIDENTATA.
B. Four incisors in upper jaw (two of them small and placed behind the others) ... ... II. DUPLICIDENTATA.

Suborder I.—SIMPLICIDENTATA.

The Families of this Suborder may be arranged in a key as follows ;—

Key to the families of SIMPLICIDENTATA.

- *A.* Angular portion of mandible arising from lower edge of bony socket of incisors.
  - *a.* Fibula distinct; skull with distinct postorbital processes ; premolars two on each side in the upper jaw, only one in the lower ... ... I. SCIURIDÆ.
  - *b.* Fibula united to tibia; no postorbital processes.
    - a^1. Form slender ; tail long.
      - a^2. Premolars one on each side in upper jaw... ... ... II. DIPODIDÆ.
      - b^2. Premolars absent.
        - a^3. Tail clothed with long hair which grows continually longer towards the tip ... III. GLIRIDÆ.
        - b^3. Tail clothed at most with short hair, occasionally forming a tassel at the extreme tip ... ... IV. MURIDÆ.
    - b^1. Form heavy, mole-like ; tail short or rudimentary. ... ... V. SPALACIDÆ.
- *B.* Angular portion of mandible arising from outer side of bony socket of incisor; body more or less covered with spines ... ... VI. HYSTRICIDÆ.

Family I.—SCIURIDÆ.

The two Subfamilies may be distinguished as follows :—

Key to the Subfamilies of SCIURIDÆ.

- *A.* Form slender; tail long ; incisors compressed ; arboreal ... ... I. SCIURINÆ.
- *B.* Form stout ; tail generally short ; incisors not compressed ; terrestrial. II. MARMOTINÆ.

Subfamily I.—SCIURINÆ.

The following is a key to the genera, *viz* :—

Key to the genera of SCIURINÆ.

- *A*. Limbs connected by a membrane or parachute.
  - *a*. Hypsodont; inner borders of upper molars proximately subangulate, their upper surfaces flat ... ... I. EUPETAURUS.
  - *b*. Brachyodont; inner borders of upper molars rounded, their upper surface irregular.
    - a^1. An interfemoral membrane attached to the tail; this latter is bushy, not distichous ... ... II. PETAURISTA.
    - b^1. No interfemoral membrane; tail distichous.
      - a^2. Strong tufts of hair at bases of ear-conch in front; teeth excessively wrinkled, posterior internal cusps well developed ... ... III. BELOMYS.
      - b^2. Ear-tufts absent or but little developed; teeth not excessively wrinkled; posterior internal cusps not developed ... ... IV. PTEROMYS.
- *B*. Limbs free, not connected by membrane.
  - *a*. Size very large ... ... V. RATUFA.
  - *b*. Size smaller.
    - a^1. Muzzle long and pointed; a pale spot behind each ear ... ... VI. DREMOMYS.
    - b^1. Muzzle comparatively blunt; no pale spots behind the ears.
      - a^2. No stripes on back.
        - a^3. No seasonal hip-patch ... VII. CALLOSCIURUS.
        - b^3. A seasonal hip-patch ... VIII. TOMEUTES.
      - b^2. Back striped.
        - a^3. A median dorsal pale line... IX. FUNAMBULUS.
        - b^3. No pale line on back.
          - a^4. Size larger; no central dorsal stripe; head and body 175 mm. ... ... X. MENETES.
          - b^4. Size smaller; a central dorsal black stripe; head and body 125 mm. ... XI. TAMIOPS.

Gen. I.—EUPETAURUS.

No. 226. *cinereus*, Thos.

DISTRIBUTION :—

E. cinereus, Thomas.
Type locality :— Gilgit.
Other localities :—None.
Co-types :—B. M. No. 88.9.28.1. and Ind. Mus. Calc. No. *a*.
Lectotype :—B. M. No. 88.9.28.1.

Gen. II.—PETAURISTA.

Established by Link in 1795, takes the place of PTEROMYS (which was only established by Cuvier in 1800) in any case; but the latter has been shown to belong to the animals classed as SCIUROPTERUS. (See below).

I published a study of this genus in 1911 (J. B. N. H. S. xx, p. 1012), when I added some new names, and several others have been added since then. On the other hand the two names *yunnanensis* and *punctatus* must be dropped from our list in favour of their representatives *candidulus* and *sybilla* respectively. The whole may be arranged in a key as follows :—

No. 227. *oral*, Tick.
No. 228. *inornatus*, Geoff.
No. 229. *magnificus*, Hodgs.
No. 230. *yunnanensis*, And.
No. 231. *caniceps*, Gray.
No. 232. *punctatus*, Gray.

Key to the species of PETAURISTA.

A.—General colouring blackish or greyish, never rufous or fulvous.

a. Smaller, hindfoot 70-77 mm.
  a^1. Smaller, hindfoot 72 mm. ... 1. *oral*, Tick.
  b^1. Larger, hindfoot 77 mm. ... 2. *cinderella*, Wr.
b. Larger, hindfoot 80-85 mm.
  a^1. Back of ears and forearm "bay"; tail drab-grey ... ... 3. *cineraceus*, Bly.
  b^1. No bay marking; tail black.
    a^2. Limbs and parachute dark maroon, under surface salmon buff ... 4. *lylei venningi*, Thos.
    b^2. Limbs and parachute like the back, at most with a rufous tinge; under surface white.
      a^3. Limbs and parachute with a rufous tinge ... ... 5. *philippensis*, Ell.
      b^3. Limbs and parachute like the back ... ... 6. *lanka*, Wr.

B.—General colouring rufous or fulvous.
  a. Size larger, hindfoot over 80 mm.
    a^1. Colour darker; black tufts behind the ears ... ... 7. *taylori*, Thos.
    b^1. Colour paler; dark bay tufts behind the ears... ... ... 8. *candidulus*, Wr.
  b. Size smaller, hindfoot 65-77 mm.
  a. Larger, hindfoot 70-77 mm.
    a^2. A well marked dark saddle patch extending forward to the crown; hindfoot 73 mm. ... 9. *nobilis*, Gr.
    b^2. No saddle patch.
      a^3. Backs of ears black.
        a^4. Colour darker, grizzled bay and buff.... ... ...10. *birrelli*, Wr.
        b^4. Colour paler, grizzled brown and white ...11. *inornatus*, Geoff.
      b^3. Backs of ears coloured like head.
        a^4. Face grey... ... ...12. *caniceps*, Gr.
        b^4. Face like head and back.
          a^5. Darker (bay); no pale area on shoulders; hind feet black ...13. *albiventer*, Gr.
          b^5. Paler (ferruginous); shoulders slightly paler than back; feet coloured like back...14. *fulvinus*, Wr.
  b^1 Smaller, hindfoot 60-65 mm. ...15. *sybilla*, Thos. & Wr.

DISTRIBUTION :—

1. *P. oral*, Tickell.	*Type locality* :—Singhboom, Orissa. (Tickell). *Other localities*, Berar; Chaibassa, Orissa (M. S. I.). *Type* :—Unknown.
2. *P. cinderella*, Wroughton.	*Type locality* :—Surat Dangs. (Wroughton). *Other localities* :—Surat Dangs. (B. M.) *Type* :—B. M. No. 96. 11. 7. 5.
3. *P. cineraceus*, Bl.	*Type locality* :—Arakan. (Phayre). *Other localities* :—Tenasserim (B. M.); Pegu (M. S. I.) *Type* :—Ind. Mus. Calc. Var. B. No. *a.*

4. *P. lylei venningi*, Thomas.	*Type locality* :—Kalaw, S. Shan States. (Venning). *Other localities* :—None. *Type* :—B. M. No. 14. 4. 3. 1.
5. *P. philippensis*, Elliot.	*Type locality* :—Southern Maratha Country. (Elliot). *Other localities* :—Nilgiri and Palni Hills, Madras ; Travancore (B. M.) ; Kanara ; Coorg (M. S. I.). *Co-types* :—B. M. No. 115 *b.* & *d.* (Co-types of *griseiventer.* Gray, B. M. No. 198 *a.* & *b.* Lectotype :—B. M. No. 198 *a.*) *Lectotype* :—B. M. No. 115 *d.*
6. *P. lanka*, Wroughton.	*Type locality* :—Ceylon (E. B. Horsborough.) *Other localities* :—Ceylon (B M.); Ceylon (M. S. I.) *Type* :—B. M. No. 96. 3. 27. 1.
7. *P. taylori*, Thomas.	*Type locality* :—Bankasun, Tenasserim (B. N. H. S.—Shortridge). *Other localities* :—None. *Type* :—B. M. No. 14. 12. 1. 5.
8. *P. candidulus*, Wroughton.	*Type locality* :—Kindat. Chindwin River (C. H. Hobart). *Other localities*:—Dilkhusha, Cachar; Naga Hills ; Mogaung, N. Burma (B. M.) ; Chin Hills ; Chindwin (M. S. I.) *Type* :—B. M. No. 10. 10. 19. 3.
9. *P. nobilis*, Gray.	*Type locality* :—Darjiling. (Pearson). *Other localities* :—Nepal (B. M.); Sikkim (M. S. I.). *Type* :—B. M. No. 79. 11. 21. 529. (Type of *chrysothrix*, Hodgson, B. M. No. 43. 1. 12. 45.).
10. *P. birrelli*, Wroughton.	*Type locality* :—Murree, Punjab (Major Birrell). *Other localities* :—Murree, Punjab (B. M.). *Type* :—B. M. No. 5. 11. 19 3.
11. *P. inornatus*, Geoffroy.	*Type locality* :—Kashmir. *Other localities* :—Kashmir (B. M.). *Type* :—Unknown. Perhaps in Paris Museum.

12. *P. caniceps*, Gray.	*Type locality*:—Darjiling. (Hodgson). *Other localities*:—Sikkim; Nepal (B.M.). *Type*:—B. M. No. 79.11.21.531. (Type of *senex*, Hodgson, B. M. No. 45.1.8.242).
13. *P. albiventer*, Gray.	*Type locality*:—Nepal (Hodgson). *Other localities*:—Nepal; Sikkim (B. M.); Kumaon (M. S. I.). *Type*:—B. M. No. 114 *c*. (Type of *magnificus*, Hodgson, B. M. No. 43. 1.12.47).
14. *P. fulvinus*, Wroughton.	*Type locality*:—Simla. (Hume—Davison). *Other localities*:—Simla (B.M.). *Type*:—B. M. No. 85. 8. 1. 121.
15. *P. sybilla*, Thomas and Wroughton.	*Type locality*:—Chin Hills. (B.N. H. S.—Mackenzie). *Other localities*:—None. *Type*:—B. M. No. 16.3.26.14.

Gen. III.—BELOMYS.

No. 238. *pearsoni*, Gray.

In 1908 Thomas divided up the genus PTEROMYS into 6. Besides restricted PTEROMYS, BELOMYS is the only one found within our limits. (A.M.N.H. (8).1.p.1). In the paper mentioned above he also added a new species *trichotis* in this genus. These two species may be distinguished as follows :—

Key to the species of BELOMYS.

A.—Backs of ears, and the ear-tufts, hazel... 1. *pearsoni*, Gray.
B.—Backs of ears, and the ear-tufts, black... 2. *trichotis*, Thos.

DISTRIBUTION :—

1. *B. pearsoni*, Gray.	*Type locality* :—Darjiling.(Pearson). *Other localities* :—Sikkim; Naga Hills. (B. M.) *Type* :—B. M. No. 79.11.21.381.
2. *B. trichotis*, Thomas.	*Type locality* :—Machi, Manipur, (Hume). *Other localities* :—Lower Chindwin, Burma. (B. M.) *Type* :—B. M. No. 85.8.1.136.

Gen. IV.—PTEROMYS.

Thomas has divided this genus up into four subgenera, three only of which are found in Indian limits. One of these, GLAUCOMYS, has been restricted by Hollister (P. Biol. Soc. Wash. xxviii, p. 109, 1915) to the American form. These three subgenera may be arranged in a key as follows:—

Key to the subgenera of PTEROMYS.

A.—Bullæ well inflated; molar ridges high.
  a. Mammæ 8 ... ... I. EOGLAUCOMYS.
  b. Mammæ 6 ... ... II. HYLOPETES.
B.—Bullæ low, flat, little inflated; molar ridges low ... ... III. PETINOMYS.

Subgen. I.—EOGLAUCOMYS.

No. 233. *fimbriatus,* Gray. The only species.

DISTRIBUTION:—

Pt. (*E.*) *fimbriatus*, Gray. *Type locality*:—"India."
Other localities:—Kashmir, Simla, Thandeani, Garial, Murree, Punjab (B. M.).
Type:—Not traced.

Subgen. II.—HYLOPETES.

No. 234. *alboniger*, Hodgs.
No. 235. *sagitta*, L.
No. 236. *spadiceus*, Blyth.

The *sagitta* of Linnæus was based on a Sumatran animal; for its Burmese representative Blyth established the species *phayrei* from Mergui. For the still more Northern form from Mt. Popa Thomas has provided the subspecific name *probus*. In 1908 Thomas established *belone* for the small flying squirrel of the Malay Peninsula, which has now been taken in Tenasserim. The species may be distinguished as follows:—

Key to the species of HYLOPETES.

A.—Size larger, hindfoot about 40 mm. ... 1 *alboniger*, Hodgs.
B.—Size smaller, hindfoot 30 mm. or less.
  a. Size medium, hindfoot about 30 mm.
    a[1]. Feet entirely brown ... ... 2. *phayrei*, Bl.
    b[1]. Sides of feet and toes pure white... 3. *p. probus*, Thos.

b. Size small, hindfoot less than 30 mm.
  *a*¹. Size larger, hindfoot 27 mm. ... 4. *belone*, Thos.
  *b*¹. Size very small, hindfoot 22 mm. 5. *spadiceus*, Bl.

DISTRIBUTION :—

1. *Pt.* (*H.*) *alboniger*, Hogdson.	*Type locality* :—Nepal (Hodgson). *Other localities* :—Sylhet; Darjiling; Sikkim; Manipur (B. M.); Sikkim; Darjiling; Bhutan Duars; Chin Hills; Chindwin (M. S. I.). *Co-types* :—B. M. Nos. 43.1.12.49—51.(Type of *turnbulli*, Gray, B. M. No. 37.6.10.57). *Lectotype* :—B. M. No. 43.1.12.49.
2. *Pt.* (*H.*) *phayrei*, Blyth.	*Type locality* ;—Rangoon, Mergui, (Phayre and Berdmore). *Other localities* :—Pegu Yomas: Siam (B. M.). *Co-types* :—Ind. Mus. Calc. Stuffed specimens. *c.* and *d.*
3. *Pt.* (*H.*) *phayrei probus*, Thomas.	*Type locality* :—Mt. Popa, 3,000′ Burma (B. N. H. S.—Shortridge). *Other localities* :—Chin Hills; Chindwin; Mt. Popa (M. S. I.) *Type* ;—B. M. No. 14.4.3.2.
4. *Pt.* (*H.*) *belone*, Thomas.	*Type locality* :—Terutao Island, Straits of Malacca. *Other localities* :—Tenasserim (M S. I.). *Type* :—B. M. No. 8.7.20.61.
5. *Pt.* (*H.*) *spadiceus*, Blyth.	*Type locality* :—Arakan. (Phayre). *Other localities* :—Mt. Popa (M.S.I.) *Co-types* :—Ind. Mus. Calc. Nos. *a*, *b*, and *c*.

Subgen. III.—PETINOMYS.

No. 237. *fuscicapillus*, Blyth.

The Ceylon form is *layardi*, Kelaart. Thomas has recently described a third species, *phipsoni*, from Tenasserim. They may be distinguished as follows ;—

Key to the species of PETINOMYS.

A.—Size large, hindfoot over 50 mm.
  a. Under surface, white ... ... 1. *fuscocapillus*, Bl.
  b. Under surface, grey... ... ... 2. *layardi*, Kel.
B.—Size small, hindfoot about 25 mm. ... 3. *phipsoni*, Thos.

DISTRIBUTION :—

1. *Pt.* (*P.*) *fuscocapillus*, Blyth. *Type locality* :—Malabar Coast. (Rev. H. Baker, Junr.).
Other localities:—Travancore (Bourdillon) (B. M.).
Type :—Lost.

2. *Pt.* (*P.*) *layardi*, Kelaart. *Type locality* :—Dimboola, Ceylon. (Palliser).
Other localities :—Ceylon (M. S. I.).
Type :—B. M. No. 52.5.9.19.

3. *Pt.* (*P.*) *phipsoni*, Thomas. *Type locality* :—Tenasserim. (B. N. H. S.—Shortridge).
Other localities :—Malay Peninsula (B. M.)
Type :—B. M. No. 14.12.8.243.

Gen. V.—RATUFA.

No. 239. *indicus*, Erxl.
No. 240. *bicolor*, Sparr.
No. 241. *macrurus*, Penn.

I dealt with this group in 1910 (J. B. N. H. S. xix, p. 880). Since then some forms from Chindwin and Burma have received names, and Thomas and myself have revised my previous paper so far as it affects Ceylon (J. B. N. H. S. xxiv, p. 34, 1915). The resulting list of 14 names may be arranged in a key as follows :—

Key to the species of RATUFA.

A.—Fore-legs yellow.
  a. Hind-legs coloured like back.
    a^1. General colour yellow buff ... 1. *dealbata*, Blanf.
    b^1. General colour rufous bay.
      a^2. Tail coloured like back.
        a^3. Size smaller, hind-foot 73-77 mm. ... ... 2. *indica indica*, Erxl.
        b^3. Size larger, hind-foot 87-92 mm. ... ... 3. *i. superans*, Ryley.
      b^2. Tail black.
        a^3. No black markings on body. 4. *i. bengalensis*, Blanf.
        b^3. Black markings on back and shoulders.
          a^4. Black markings only on shoulder and forearm, and at base of tail ... 5. *i. centralis*, Ryl.

b^1. Black markings almost hiding the general colour except a narrow band on centre of body ... ... 6. *i. maxima*, Schreb.

b. Hindlegs yellow, in contrast with back.

- a^1. General colour black.
  - a^2. Tail hairs tipped with white ... 7. *macroura*, Penn.
  - b^2. Tail entirely black .. ... 8. *m. melanochra*, T. & W.
- b^1 General colour grizzled ... ... 9. *m. dandolena*, T. & W.

B.—Fore-legs black and brown.

a. Upper side of forearm unbroken black or brown.

- a^1. General colour black ... ... 10. *gigantea*, McCl.
- b^1. General colour brown ... ... 11. *g. lutrina*, T. & W.

b. Yellow bar across forearm.

- a^1. Dorsal surface unicolorous.
  - a^2. General colour brown... ... 12. *phœopepla*, Mill.
  - b^2. General colour black ... ... 13. *p. marana*, T. & W.
- b^1. Head and shoulders black, withers to rump brown ... ... 14. *fellii*, T. & W.

DISTRIBUTION :—

1. *R. dealbata*, Blanford.	*Type locality* :—Surat Dangs (Wroughton). *Other localities* :—Surat Dangs (B. M). *Type* :—B. M. No. 96. 11. 7. 6.
2. *R. indica indica*, Erxleben.	*Type locality* :—Bombay. *Other localities* :—Western Ghats (Sykes); Kanara ; Coorg (B. M.); Satara ; Dharwar ; Kanara ; Mysore (M. S. I.). *Type* :—Unknown. (Co-types of *elphinstonei*, Sykes B. M. No. 79. 11. 21. 578 and 579 and 16. 3. 9. 12. Lectotype B. M. No. 79.11. 21.579.)
3. *R. indica superans*, Ryley.	*Type locality* :—Wotekalli, S. Coorg. (B. N. H. S.—Shortridge). *Other localities* :—Coorg (M.S.I.). *Type* :—B. M. No. 13. 6. 21. 3.

4. *R. indica bengalensis*, Blanford.	*Type locality* :—Not known. *Other localities* :—Mysore (B. M.) Coorg (M. S. I.). *Type* :—B. M. No. 44. 7. 4. 7.
5. *R. indica centralis*, Ryley.	*Type locality* :—Hoshangabad, Central Provinces. (B. N. H. S.—Crump). *Other localities* :—Central Provinces ; Orissa (M. S. I.). *Type* :—B. M. No. 12. 11. 29. 85.
6. *R. indica maxima*, Schreber.	*Type locality* :—Malabar. *Other localities* :—Travancore ; Kodaikanal ; Madras (B. M.) *Type* :—Unknown.
7. *R. macroura macroura*, Pennant.	*Type locality* :—Ceylon. *Other localities* :—Ceylon (B. M.). *Type* :—Unknown.
8. *R. macroura melanochra*, Thomas and Wroughton.	*Type locality* :—Koltawa, South. Ceylon (B. N. H. S.—Mayor.) *Other localities* :—Ceylon (B. M.); Ceylon (M. S. I.). *Type* :—B. M. No. 15. 7. 1. 4.
9. *R. macroura dandolena*, Thomas and Wroughton.	*Type locality* :—Wellawaya, Uva Provinces, Ceylon (B. N. H. S.—Maj. Mayor) *Other localities* :—Ceylon (B. M.). North Central, East and South Ceylon (M. S. I.). *Type* :—B. M. No. 15. 7. 1. 5.
10. *R. gigantea gigantea*, McClelland.	*Type locality* :—Assam. (McClelland.) *Other localities* :—Nepal ; Sikkim-Chindwin ; Myitkyina and Mandalay, Burma (B. M.) ; Sikkim ; Darjiling ; Shan States (M. S. I.); *Type* :—B. M. No. 79. 11. 21 336.(Co-types of *macruroides*, Hodg. son, 43. 1. 12. 76 and 77. Lectotype B. M. No. 43. 1. 12. 76).
11. *R. gigantea lutrina*, Thomas and Wroughton.	*Type locality* :—Tatkon, Chindwin River. (B. N. H. S.--Shortridge). *Other localities* :—Chin Hills ; Chindwin (M. S. I). *Type* :—B. M. No. 15. 5. 5. 52.

12. *R. phœopepla phœopepla*, Miller.	*Type locality* :—Sungei Balik, Tenasserim. (Abbott). *Other localities* :—Mergui, Tenasserim ; Siam (B. M.) ; Tenasserim (M. S. I.). *Type* :—U. S. Nat. Mus. No. 124235.
13. *R. phœopepla marana*, Thomas and Wroughton.	*Type locality* :—Mt. Popa, Burma. (B. N. H. S.—Shortridge). *Other localities* :—Siam (B. M.); Mt. Popa (M. S. I.). *Type* :—B. M. No. 14. 7. 19. 107.
14. *R. fellii*, Thomas and Wroughton.	*Type locality* :—Yin, Chindwin River. (B. N. H. S.—Shortridge.) *Other localities* :—Lower Chindwin (M. S. I). *Type* :—B. M. No. 15. 5. 5. 55.

Gen. VI.—DREMOMYS.

No. 243. *locria*, Hodgs.
No. 244. *rufigenis*, Blanf.

Both these species have had, subspecies attached to them from various localities, and Thomas has recently recorded the occurrence of the Chinese *pernyi* group within our limits (J. B. N. H. S. xxiv, p. 417, 1916). Finally Thomas and myself described *macmillani*, from the Chin Hills (J. B. N. H. S., p. 238, 1916). All these Thomas arranged in a key (l. c.) somewhat as follows :—

Key to the species of DREMOMYS.

A.—Cheeks not ferruginous ; tail, below, dully coloured grizzled.
  a. Belly hairs strongly buffy or ochraceous terminally.
    a^1. Belly washed with rich ochraceous ; ear patches white ; back entirely without a median black line.
      a^2. A fulvous tinge above, giving a browner appearance ... ... 1. *lokria lokria*, Hodgs.
      b^2. No fulvous tinge, especially on lower back, general appearance blackish olivaceous ... ... 2. *lokria bhotia*, Wr.
    b^1. Belly washed with buffy or yellowish ; ear patches rufous ; a dark median dorsal line usually present, though indistinct in worn pelage ... 3. *macmillani*, T. & W.

b. Belly hairs whitish or creamy terminally ; ear patches rufous ... ... 4. *pernyi*, M. Edw.
B.—Cheeks and midrib of tail beneath bright ferruginous.
a. Colour darker.
a^1. Tail hairs not markedly whitened ... 5. *r. rufigenis*, Blanf.
b^1. Tail hairs markedly tipped white ... 6. *r. opimus*, Thos.
b. Colour paler ... ... 7. *r. adamsoni*, Thos.

DISTRIBUTION :—

1. ***D. lokria lokria***, Hodgson.	*Type locality* :—Nepal. (Hodgson). *Other localities* :—Darjiling ; Manipur (B. M.) Chin Hills (Mackenzie) (M. S. I.). *Co-types* :—B. M. Nos. 43. 1. 12. 55 and 56. (Type of *subflaviventris*, McClelland, B. M. No. 79. 11. 21. 351). *Lectotype* :—B. M. No. 43.1.12.55.
2. ***D. lokria bhotia***, Wroughton.	*Type locality* :—Sedonchen, Sikkim. (B. N. H. S.—Crump). *Other localities* :—Eastern Sikkim, (M. S. I.) *Type* :—B. M. No. 15.9.1.125.
3. ***D. macmillani***, Thomas and Wroughton.	*Type locality* :—Tatkon, Chindwin. (B. N. H. S.—Macmillan). *Other localities* :—Kabaw Valley (M. S. I.). *Type*:—B. M. No. 15.5.5.198.
4. ***D. pernyi***, Milne—Edwards.	*Type locality* :—Sze Chwan, Yunnan (Perny). *Other localities* :—Yunnan (B. M.); Chin Hills (M. S. I.). *Type* :—Paris Museum.
5. ***D. rufigenis rufigenis***, Blanford.	*Type locality* :—Mt. Mooleyit, Burma. (Hume—Davison.) *Other localities*:—Mooleyit(B.M.). *Type* :—B. M. No. 91. 10. 7. 81.
6. ***D. rufigenis opimus***, Thomas and Wroughton.	*Type locality* :—Hkamti, Chindwin (B. N. H. S.—Shortridge). *Other localities* :—Hkamti, Chindwin. (M. S. I.). *Type* :—B. M. No. 15. 5. 5. 195.

7. *D. rufigenis adamsoni*, Thomas. *Type locality*:—Maymyo, Burma. (J. P. Cook).
Other localities:—S. Shan States (B. M.); Kindat, Chindwin; N. Shan States (M. S. I.).
Type:—B. M. No. 14. 4. 3. 3.

Gen. VII.—CALLOSCIURUS.

No. 242. *ferrugineus*, F. Cuv.
No. 245. *erythrœus*, Pall.
No. 246. *quinquestriatus*, And.
No. 249. *caniceps*, Gray.
No. 250. *griseimanus*, M.-Edw.
No. 252. *atrodorsalis*, Gray.

Of these six species, *griseimanus*, Milne-Edwards, must be dropped from our list as occurring exclusively beyond our limits. On the other hand *sladeni*, And., entered by Blanford in the synonymy of *erythrœus*, must be recognised not only as a species, but as, like *erythrœus*, representing a group of geographically varying forms. The following key may be used for the forms here included in this genus, *viz*:—

Key to the species of CALLOSCIURUS.

A.—Feet pale; face and feet coloured like the underside.
  a. Tail-tip black; an ochraceous dorsal cloak ... ... 1. *caniceps*, Gray.
  b. Tail-tip coloured like the underside; no dorsal cloak ... ... 2. *sladeni* group. (*for key see below.*)
B.—Feet dark.
  a. General colour bay or maroon; feet black; tail tip white ... ... 3. *ferrugineus*, F. Cuv.
  b. General colour grizzled.
    a^1. Black splashes or stripes on back.
      a^2. Underside maroon ... ... 4. *atrodorsalis*, Gray.
      b^2. Underside like flanks, washed with yellow... ... ... 5. *a. shanicus*, Ryl.
    b^1. No black dorsal marks.
      a^2. Underside grey or grizzled.
        a^3. Underside grey ... ... 6. *stevensi*, Thos.
        b^3. Underside grizzled.
          a^4. Face ochraceous; no shoulder mark... ... 7. *crumpi*, Wr.

b^4. Face like head; a buffy mark on shoulder and at base of neck ... ... 8. *epomophorus davisoni*, Bonh.

b^2. Underside ochraceous to maroon.

a^3. Strong black tail-tip ... 9. *erythræus* group (*for key see below.*)

b^3. Black tail-tip obsolescent or absent.

a^4. Absent ... ...10. *rubeculus*, Mill.

b^4. Obsolescent.

a^5. Underside ferruginous with grizzled median stripe ... ...11. *gordoni*, And.

b^5. Underside white with median and lateral black stripes ...12. *quinquestriatus*, And.

DISTRIBUTION :—

1. *C. caniceps*, Gray. *Type locality* :—Tenasserim.

Other localities :—Salween River; Amherst District; Tavoy; Tenasserim (B. M.).

Type :—B. M. No. 213 a. (Cotypes of *chrysonotus*, Blyth, Ind. Mus. Calc. Nos. a^2-d^2.)

2. *C. sladeni* group. The forms included in this group may be arranged in a key as follows:-

Key to the forms of the C. sladeni group.

A.—Feet ochraceous or ferruginous.

a. Ochraceous mask extending back to level of ears... ... ... (*a*) *sladeni sladeni*, And.

b. Mask not extending back to ears.

a^1. Back above grey, not rufous ... (*b*) *s. midas*, Thos.

b^1. Back washed with ferruginous.

a^2. Feet darker, ferruginous ... (*c*) *s. rubex*, Thos.

b^2. Feet paler, ochraceous ... (*d*) *s. shortridgei*, T. and W.

B.—Feet whitish or buffy white.

a. Back grizzled.

a^1. Darker, general colour olivaceous ... ... (*e*) *s. millardi*, T. and W.

b^2. Paler, general colour tawny ochraceous ... ... (*f*) *s. fryanus*, T. and W.

b. Back not grizzled.

a^3. General colour ochraceous ... (*g*) *s. careyi*, T. & W.
b^2. General colour cream buff ... (*h*) *s. haringtoni*, Thos.

2. (*a*) *C. sladeni sladeni*, Anderson.	*Type locality*:—Thigyain, Upper Burma. *Other localities*:—Katha, Upper Burma; Uyu River, Chindwin; (B.M.). Kindat, Chindwin (M. S. I.). *Type*:—Ind. Mus. Calc. No. *a*. (Type of *kemmisi*, Wroughton, B. M. No. 8. 8. 17. 3.; Type of *sladeni bartoni*, Thomas, B. M. No. 14. 6. 18. 1.)
2. (*b*) *C. sladeni midas*, Thomas.	*Type locality*:—Myitkyina, Upper Burma. (Kemmis). *Other localities*:—None. *Type*:—B. M. No. 11. 7. 31. 1.
2. (*c*) *C. sladeni rubex*, Thomas.	*Type locality*:—Myitkyina, Upper Burma (B. N. H. S.—Venning). *Other localities*:—Yin, Lower Chindwin (M. S. I.). *Type*:—B. M. No. 14. 4. 3. 7.
2. (*d*) *C. sladeni shortridgei*, Thomas and Wroughton.	*Type locality*:—Hkamti, Upper Chindwin. (B. N. H. S.—Shortridge). *Other localities*:—Hkamti (M. S. I.). *Type*:—B. M. No. 15. 5. 5. 104.
2. (*e*) *C. sladeni millardi*, Thomas and Wroughton.	*Type locality*:—Pyaungbyin, Upper Chindwin, (B. N. H. S.—Shortridge). *Other localities*:—Pyaungbyin, Upper Chindwin (M. S. I.). *Type*:—B. M. No. 15. 5. 5. 136.
2. (*f*) *C. sladeni fryanus*, Thomas and Wroughton.	*Type locality*:—Minsin, Upper Chindwin (B. N. H. S.—Shortridge). *Other localities*:—Minsin, Kaungtaung, Upper Chindwin. (M. S. I.). *Type*:—B. M. No. 15. 5. 5. 117.
2. (*g*) *C. sladeni careyi*, Thomas and Wroughton.	*Type locality*:—Tamanthe, Upper Chindwin, (B. N. H. S.—Shortridge). *Other localities*:—Tamanthe (M.S.I.) *Type*:—B. M. No. 15. 5. 5. 121.
2. (*h*) *C. sladeni haringtoni*, Thomas.	*Type locality*:—Moungkan, Upper Chindwin (Harington).

	Other localities:—Moungkan, Homalin, Chindwin (M. S. I.) *Type*:—B. M. No. 5.8.11.1. (Type of *haringtoni solutus*, Thomas, (Homalin), B. M. No. 5.8.11.2).
3. *C. ferrugineus*, F. Cuvier.	*Type locality*:—Pegu (Belanger). *Other localities*:—Rangoon (B.M.); Pegu Yomas, Mt. Popa (M. S. I.) *Type*:—Unknown. Probably in Paris Museum.
4. *C. atrodorsalis*, Gray.	*Type locality*:—"Bhotan" (palpably an error). *Other localities*:—Amherst District; Moulmein; Tenasserim; S.W. Siam (B.M.). *Type*:—B.M. No. 41.1819. (Type of *hyperythrus*, Blyth (Tenasserim), Ind. Mus. Calc. No. o^2).
5. *C. atrodorsalis shanicus*, Ryley.	*Type locality*:—Gokteik, N. Shan States. (B. N. H. S.—Shortridge). *Other localities*:—Shan States; Mt. Popa (M. S. I.) *Type*:—B. M. No. 13.11.18.1.
6. *C. stevensi*, Thomas.	*Type locality*:—Beni Chang, Abor-Miri Hills, Assam. (Stevens). *Other localities*:—Abor Country (Bailey); Sadiya, Assam (B. M.). *Type*:—B. M. No. 7. 11. 26. 2.
7. *C. crumpi*, Wroughton.	*Type locality*:—Sedonchen, Sikkim. (B. N. H. S.—Crump). *Other localities*:—Sedonchen (M. S. I.). *Type*:—B. M. No. 15. 9. 1. 103.
8. *C. epomophorus davisoni*, Bonhote.	*Type locality*:—Bankachon, Tenasserim (Hume—Davison). *Other localities*:—Moulmein; S. W. Siam (B. M.); Tenasserim (M. S. I.) *Type*:—B. M. No. 85.8.1.187.
9. *C. erythræus* Group.	The forms included in this group may be arranged in a key as follows;—

Key to the forms of the C. erythræus group.

A.—Ears red or brown.

a. Face the same colour as the back ... (*a*) *e. erythræus*, Pall.

b. Face ochraceous ... ... (*b*) *e. bhutanensis*, Bonh.

B.—Ears like the rest of the head.
  a. Very dark, almost black.
    a^1. Grizzling coarser... ... ... (*c*) *e. erythrogaster*, Bl.
    b^1. Grizzling very fine ... ... (*d*) *e. punctatissimus*, Gr.
  . Paler.
    a^1. Tail white with black tip ... (*e*) *e. kinneari*, Th. & Wr.
    b^1. Tail like back; with black tip.
      a^2. Colour of inside of limbs extending to front of wrists and back of ankle; tail usually with much white in black tip. (*f*) *e. crotalius*, Th. & Wr.
      b^2. Front of wrists and back of ankles coloured like rest of outer side of limb; tail with black tip ... ... (*g*) *e. nagarum*, Th. & Wr.

9. (*a*) *C. erythræus erythræus*, Pallas.	*Type locality*:—"ex India orientali." *Other localities*:—Assam (Griffith) (B. M.) *Type*:—Unknown.
9. (*b*) *C. erythræus bhutanensis*, Bonhote.	*Type locality*:—Bhutan. *Other localities*:—Assam (McClelland) (B. M.). *Type*:—B. M. No. 43. 8. 18. 6.
9. (*c*) *C. erythræus ergthrogaster*, Blyth.	*Type locality*:—Manipur (A. S. B., Guthrie). *Other localities*:—Aimole and Noong-zai-ban, Manipur (B. M.). *Type*:—Ind. Mus. Calc. No. *a*.
9. (*d*) *C. erythræus punctatissimus*, Gray.	*Type locality*:—Cachar. *Other localities*:—Dilkoosha, Cachar (B. M.). *Type*:—B. M. No. 55.12.24.108.
9. (*e*) *C. erythræus kinneari*, Thomas & Wroughton.	*Type locality*:—Tatkon, Upper Chindwin, (B. N. H. S.—Shortridge). *Other localities*:—Tatkon (M. S. I.) *Type*:—B. M. No. 15.5.5.79.
9. (*f*) *C. erythræus crotalius*, Thomas & Wroughton.	*Type locality*:—Hkamti, Upper Chindwin (B. N. H. S.—Shortridge). *Other localities*:—Hkamti (M. S. I.). *Type*;—B. M. No. 15. 5. 5. 69.

9. (*g*) *C. erythræus nagarum*, Thomas and Wroughton.	*Type locality* :—Sadiya, Assam (Hume). *Other localities* :—Homalin, Tamanthe, Upper Chindwin ; Chin Hills (M. S. I.). *Type* :—B. M. No. 85. 8. 1. 170.
10. *C. rubeculus*, Miller.	*Type locality* :—Trong, S. W. Siam. (Abbott). *Other localities* :—None. *Type* :—U. S. Nat. Mus. No. 86777.
11. *C. gordoni*, Anderson.	*Type locality* :—Bhamo, Upper Burma. (Anderson). *Other localities* :—Bhamo (Doria, Harington) (B. M.). *Co-types* :—Ind. Mus. Calc. Nos. h^2-k^2.
12. *C. quinquestriatus*, Anderson.	*Type locality* :—Ponsee, Kakhyen Hills (Anderson). *Other localities* :—Bhamo, Myitkyina (Kemmis). Upper Burma (B. M.); *Type* :—Ind. Mus. Calc. No. *d*.

Gen. VIII.—TOMEUTES.

No. 247. *phayrei*, Bl.
No. 248. *pygerythrus*, Geoff.
No. 251. *locroides*, Hodgs.

The name *blanfordi*, Blyth, placed by Blanford in the synonymy of *pygerythrus*, Geoffroy, was on the advice of Mr. Thomas transferred provisionally to *phayrei*, Blyth, (J. B. N. H. S. xxiii, p. 473, 1915). Thomas established a subspecies *janetta* (J. B. N. H. S. xxiii, p. 202, 1914) for the Northern form of *pygerythrus*. Bonhote in 1906 described *mearsi* as a subspecies of *lokroides* (A. M. N. H. (7), xviii, p. 337) ; but the Survey Collections show, not only that it must be treated as a species, but that two subspecies, *virgo* and *bellona*, were necessary for local races of it found higher up the Chindwin (J. B. N. H. S. xxiv, p. 419, 1916). These four species and their subspecies may be arranged in a key as follows :—

Key to the species and subspecies of TOMEUTES.

A.—Tail-tip black.
  a. Size larger, hindfoot about 50 mm. ; black tail-tip strongly marked ...
    a^1. A broad black band on each flank ; feet ochraceous buff. ... ... 1. *phayrei*, Blyth.

b^1. No lateral stripes; feet buff. ... 2. *p. blanfordi*, Blyth.

b. Size smaller, hindfoot about 40 mm.; tail-tip less distinctly black.

a^1. Feet dark, coloured like back. ... 3. *pygerythrus*, Geoff.

b^1. Feet pale, "cream buff". ... 4. *p. janetta*, Thos.

B.—No black tail-tip.

a. Feet dark; thigh patches red.

a^1. No grey median line on chest and abdomen ... ... 5. *lokroides*, Hodgs.

b^1. A grey median line on chest and abdomen ... ... 6. *l. owensi*, Th.&Wr.

b. Feet pale; thigh patches white or buffy.

a^1. Thigh patch buffy. ... ... 7. *mearsi*, Bonh.

b^1. Thigh patch white.

a^2. Thigh patch all white ... 8. *m. virgo*, Th. & Wr.

b^2. Thigh patch white, edged by an ochraceous flush. ... ... 9. *m. bellona*, Th. & Wr.

DISTRIBUTION:—

1. *T. phayrei phayrei*, Blyth.	*Type locality*:—Martaban. (Berdmore and Phayre). *Other localities*:—Martaban (Blyth); N. Tenasserim (B. M.); N. Shan States; Ngapyinin, Irrawady, (East Bank) (M. S. I.). *Co-types*:—B. M. Nos. 62.7.16.7 & 8; Ind. Mus. Calc., Nos. *a*. *b*. and *c*.
2. *T. phayrei blanfordi*, Blyth.	*Type locality*:—Ava, Burma. (Blanford). *Other localities*:—Mandalay (B.M.). *Co-types*:—B. M. No. 63. 5. 9. 9.; Ind. Mus. Calc. No. *a*.
3. *T. pygerythrus pygerythrus*, Geoffroy.	*Type locality*:—Pegu (Belanger). *Other localities*:—Rangoon; Pegu; Moulmein (B. M.); Pegu (M. S. I.). *Type*:—Paris Museum.
4. *T. pygerythrus janetta*, Thomas.	*Type locality*:—Mandalay. (B. N. H. S.—Shortridge). *Other localities*:—Nyoungbintha, Upper Burma (Harington); Pyawbwe, Upper Burma (B. M.); Mt. Popa; Mingun and Mandalay, Upper Burma; Lower Chindwin (M.S.I.) *Type*:—B. M. No. 4. 12. 1. 4.

5. *T. lokroides lokroides*, Hodgson.	*Type locality :*—Nepal (Hodgson). *Other localities :*—Dacca, Bengal; Nepal; Sikkim; Bhotan; Manipur (B. M.) Sikkim; Darjiling; Bhutan Duars (M. S. I.). *Co-types :*—B. M. Nos. 43.1.12. 58. and 59. (Co-types of *similis*, Gray, B.M. Nos. 43.1.12.53. and 54; Lectotype B. M. No. 43.1.12.54; Co-types of *blythii*, Tytler, B. M. No. 79.11.21. 361 and 362; Lectotype B. M. No. 79. 11.21.361; Type of *assamensis*, McClelland, B. M. No. 79.11.21. 384). *Lectotype :*—B. M. No. 43.1.12.58.
6. *T. lokroides owensi*, Thomas and Wroughton.	*Type locality :*—Minsin, Chindwin (B. N. H. S.—Shortridge). *Other localities :*—Chindwin (M. S. I.). *Type :*—B. M. No. 15. 5. 5. 189.
7. *T. mearsi mearsi*, Bonhote.	*Type locality :*—Chinbyit, Lower Chindwin. (Mears). *Other localities :*—Chinbyit (B. M.) Chindwin (M. S. I.). *Type :*—B. M. No. 6. 7. 5. 10.
8. *T. mearsi virgo*, Thomas and Wroughton.	*Type locality :*—Tatkon, Chindwin. (B. N. H. S.—Shortridge). *Other localities :*—Chindwin (M.S.I.) *Type :*—B. M. No. 15.5.5.169.
9. *T. mearsi bellona*, Thomas and Wroughton.	*Type locality :*—Kin, Lower Chindwin. (B. N. H. S.—Shortridge). *Other localities :*—Chindwin (M.S.I.) *Type :*—B. M. No. 15.5.5.177.

Gen. IX.—FUNAMBULUS.

The genus FUNAMBULUS was established by Lesson in 1832 for the *Sciurus palmarum*, L., but was not generally adopted. As late as 1897 Thomas mentions it (P. Z. S. p. 933), but in a much wider sense than that now accepted. Thomas in 1908 (J. B. N. H. S., xviii, p. 246), finally restricted it as now used. It is interesting to note that no member of the genus is found outside the Indian Peninsula, south of the River Ganges, and that at the same time no other form of squirrel, excluding the flying and giant squirrels, is found within its range.

No. 253. *palmarum*, L.
No. 254. *tristriatus*, Waterh.
No. 255. *layardi*, Bl.
No. 256. *sublineatus*, Waterh.

Many years ago I pointed out that the name *palmarum* was originally given to the Madras squirrel, and had wrongly been confused with the northern form with five white stripes (J. B. N. H. S. xvi, p. 406, 1905), for which latter I proposed the name *pennanti*, with a subspecies *argentescens*, for the extreme northern form, and more recently (J. B. N. H. S., xxiv, p. 430, 1916), the subspecific name *lutescens*, for the Kathiawar squirrel. In my original paper (l. c.) I suggested *comorinus* as a subspecific name for the Malabar form of *palmarum*, and more recently Thomas and myself proposed the subspecific names *favonicus*, *olympius*, *brodiei* and *kelaarti* for Ceylon forms of *palmarum* (J. B. N. H. S., xxiv, p. 39, *et seq.* 1915), and *kathleenæ* for the Ceylon form of *sublineatus*, Waterhouse. Finally, quite recently I established two new species *bengalensis*, and *robertsoni*, and two subspecies, *viz.*, *bellaricus* of *palmarum*, and *numarius* of *tristriatus* for forms which the Survey Collections showed required names.* All these may be arranged in key as follows:—

Key to the species of FUNAMBULUS.

A.—Underside white, only occasionally tinged with fulvous or rufous.

a. Three pale dorsal stripes; mid-rib of tail below ferruginous.

a^1. Greatest length of skull 40mm. or less.

a^2. Pale dorsal stripes all three buff.

a^3. Face ochraceous.

a^4. General colour paler; feet whitish ... ... 1. *palmarum*, L

b^4. General colour darker; feet like the body ... ... 2. *p. comorinus*, Wr.

b^3 Face like head, not ochraceous... ... ... 3. *p. brodiei*, Bl.

b^2 Pale dorsal stripes not all three buff.

a^3. Central dorsal stripe white, laterals buff.

a^4. Face ochraceous.

a^5. Median stripe pure white... ... ... 4. *p. kelaarti*, Lay.

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*Quite recently Robinson has described a peninsular form of the Ceylon *layardi* under the name *dravidianus*.

b^{5}. Median stripe buffy white... ... ... 5. *p. favonicus*, Th. and Wr.

b^{4}. Face like head, not ochraceous ... ... 6. *p. olympius*, Th. and Wr.

b^{3}. All three dorsal stripes white.

a^{4}. Size larger, head and body about 170 mm.... ... 7. *p. bellaricus*, Wr.

b^{4}. Size smaller, head and body about 140 mm.

a^{5}. A pinkish tinge on flanks ... ... 8. *bengalensis*, Wr.

b^{5}. No pinkish tinge on flanks ... ... 9. *robertsoni*, Wr.

b^{1}. Greatest length of skull 42 mm. or more.

a^{2}. Dorsal stripes white.

a^{3}. Size large, hindfoot 46 mm. 10. *wroughtoni*, Ryl.

b^{3}. Size smaller, hind foot 41 mm. ... ... 11. *tristriatus*, Wat.

b^{2}. Dorsal stripes buff ... ... 12. *t. numarius*, Wr.

b. Five pale dorsal stripes; no rufous mid-rib to tail.

a^{1}. General colour darker... ... 13. *pennanti*, Wr.

b^{1}. General colour paler

a^{2}. Saddle dark grey ... ... 14. *p. argentescens*, Wr.

b^{2}. Saddle strongly suffused with fulvous ... ... 15. *p. lutescens*, Wr.

B.—Underside not white.

a. Underside chestnut or orange.

a^{1}. Underside chestnut; crown and cheeks coloured like the flanks. 16. *layardi*, Bly.

b^{1}. Underside "yellowish orange" crown and cheeks "rich rufus orange" ... ... 17. *dravidianus*, Rob.,

b. Underside drab.

a^{1} Distance between pale dorsal stripes wider, 7—8 mm. ... 18. *kathleenæ*, Th. and Wr.

b^{1}. Distance between pale dorsal stripes narrow, 4—5 mm. ... 19. *sublineatus*, Waterh.

Note.—At the same time as *F. dravidianus* (Rec. Ind. Mus. p. 42. 1917) mentioned above Robinson described a specimen from Travancore as *F. tristriatus annandalei*. From that description I am unable to distinguish it from a series from that State sent to the National Collection by Maj. H. Ferguson, which in their turn appear to me indistinguishable from Waterhouse's type of *tristriatus*.

DISTRIBUTION :—

1. *F. palmarum palmarum*, L.	*Type locality* :—" America, Asia, Africa," Madras (selected by me). *Other localities* :—Madras (Thurston) (B. M.). *Type* :—Unknown.
2. *F. palmarum comorinus*, Wroughton.	*Type locality* :—Trevandrum, Travancore. (H. Ferguson). *Other localities* :—Travancore (Ferguson) (B. M.). *Type* :—B. M. No. 95. 10. 9. 19.
3. *F. palmarum brodiei*, Blyth.	*Type locality* :—Northern Province, Ceylon (Layard). *Other localities* :—Ceylon (Kelaart) (B. M.); Northern Province, Ceylon (M. S. I.). *Type* :—Ind. Mus. Calc. No. *s*.
4. *F. palmarum kelaarti*, Layard.	*Type locality* :—Southern Province, Ceylon (Layard). *Other localities* :—N. W. Ceylon (B. M.); North Western, North Central, Southern and Eastern Provinces of Ceylon. (M. S. I.). *Type* :—Ind. Mus. Calc. No. *k*.
5. *F. palmarum favonicus*, Thomas & Wroughton.	*Type locality* :—Udugama, S. Ceylon (B. N. H. S.—Mayor). *Other localities* :—Udugama, Ranna and Kottawa, S. Ceylon. *Type* :—B. M. No. 15. 7. 1. 2.
6. *F. palmarum olympius*, Thomas & Wroughton.	*Type locality* :—Urugalla, 1,600′, C. Ceylon. (B. N. H. S.—Mayor). *Other localities* :—Peradeniya (Green), Kandy, C. Ceylon (B. M.); Peradeniya, Urugalla and Ambawela, C. Ceylon (M. S. I.). *Type* :—B. M. No. 15. 7. 1. 3.
7. *F. palmarum bellaricus*, Wroughton.	*Type locality* :—Viziyanagar, Mysore (B. N. H. S.—Shortridge). *Other localities* :—Dharwar District; Viziyanagar and Bangalore, Mysore (M. S. I.). *Type* :—B. M. No. 13. 4. 10. 39.

8. *F. bengalensis*, Wroughton.	*Type locality* :—Hazaribagh, Behar. (B. N. H. S.—Crump). *Other localities* :—Hazaribagh District (M. S. I.). *Type* :—B. M. No. 15. 4. 3. 77.
9. *F. robertsoni*, Wroughton.	*Type locality* :—Pachmari, Central Provinces (B. N. H. S.—Crump). *Other localities* :—Nimar ; Berars ; Central Provinces (M. S. I.). *Type* :—B. M. No. 12. 11. 29. 92.
10. *F. wroughtoni*, Ryley.	*Type locality* :—Srimangala, 2,782′, S. Coorg. (B. N. H. S.—Shortridge). *Other localities* :—South Coorg (M. S. I.). *Type* :—B. M. No. 13. 8. 22. 48.
11. *F. tristriatus tristriatus*, Waterhouse.	*Type locality* :—" S. India." (? Malabar). *Other localities* :—" Madras " (Elliot, Jerdon); Wynaad ; Travancore (Ferguson) (B.M.). *Type* :—B. M. No. 55. 12. 24. 112.
12. *F. tristriatus numarius*, Wroughton.	*Type locality* :—Helwak, Satara District (B. N. H. S.—Prater). *Other localities* :—Western Ghats ; Kanara ; West Mysore (M. S. I.). *Type* :—B. M. No. 15. 7. 3. 26.
13. *F. pennanti pennanti*, Wroughton.	*Type locality* :—Mandvi, Surat District. (Wroughton). *Other localities* :—Sehore, Central India (Whitehead) (B. M.) ; Khandesh ; Nimar ; Berars ; Central Provinces ; Gwalior ; Dekhan ; Kumaon ; Behar (M. S. I.). *Type* :—B. M. No. 98.4.2.25.
14. *F. pennanti argentescens*, Wroughton.	*Type locality* :—Rawalpindi, Punjab (Major Birrell). *Other localities* :—Sind ; North-West Frontier (B. M.) ; Sind(M.S.I.). *Type* :—B. M. No. 5.4.2.3.
15. *F. pennanti lutescens*, Wroughton.	*Type locality* :—Deesa, Palanpur State (B. N. H. S.—Crump). *Other localities* :—Cutch ; Kathiawar ; Palanpur (M. S. I.). *Type* :—B. M. No. 13.9.18.105.

16. *F. layardi*, Blyth. *Type locality*:—Ambegamoa Hills, Ceylon. (Layard).

Other localities:—Ceylon (Cuming) (B. M.); Ratnapura, Ceylon (M.S.I.)

Type:—Ind. Mus. Calc. No. *a*.

17. *F. dravidianus*, Robinson. *Type locality*:—Western Ghats, Travancore. (Annandale)

Other localities:—None.

Type:—Ind. Mus. Calc. No. 9773.

18. *F. kathleenæ*, Thomas and Wroughton. *Type locality*:—Kottawa, Ceylon (Mayor).

Other localities:—Kottawa and Pattipola, Ceylon (M. S. I.).

Type:—B. M. No. 15.7.1.1.

19. *F. sublineatus*, Waterhouse. *Type locality*:—Nilgiri Hills, Madras.

Other localities:—Coonoor (Day); Kodi Kanal; Travancore (B. M.); S. Coorg (M. S. I.).

Type:—B. M. No. 55.12.24.321. (Type of *delesserti*, Gervais, B. M. No. 217. a.).

Gen. X.—MENETES.

This genus was separated from SCIURUS by Thomas in 1908 (J. B. N. H. S., xviii, p. 244).

No. 258. *berdmorei*, Blyth. Thomas in 1914 (J. B N. H. S., xxiii, p. 23) examined this group, and recognised five geographical races, of which only two, *viz.*, true *berdmorei* and *decoratus*, Thomas, are found within our area. They may be distinguished as follows:—

Key to the genus MENETES.

A.—Median dorsal black line and upper lateral ones present but not conspicuous; underside strongly washed with buffy ... ... 1. *berdmorei*, Bl.

B.—Median dorsal, and upper lateral, dark stripes very prominent; an additional blackish stripe edging the belly; underside and tips of tail-hairs pure white ... ... 2. *b. decoratus, Th.*

DISTRIBUTION :—

1. *M. berdmorei*, Blyth. *Type locality* :—Tenasserim. (A. S. B.—Blyth).
Other localities :—Rangoon ; Martaban ; Tenasserim (B. M.).
Type :—Not traced.

2. *M. berdmorei decoratus*, Thomas. *Type locality* :—Mt. Popa 4,000′, Burma (B.M.H.S.—Shortridge).
Other localities :—Mt. Popa (M.S.I.).
Type :—B. M. No. 14.4.3.4.

Gen. XI.—TAMIOPS.

No. 257. *macclellandi*, Horsf.

This genus was separated by Allen in 1906 (Bull. Am. Mus. xxii, p. 475), and adopted by Thomas in 1908 (J. B. N. H. S. xviii, p. 246).

Bonhote dealt with this group in 1900 (A. M. N. H. (7), v., p. 50), and recognised eight forms. Three only of these, however, are found within Indian limits, *viz.*, typical *macclellandi*, and the subspecies *manipurensis* and *barbei*. These may be distinguished as follows :—

Key to the genus TAMIOPS.

A.—One dorsal black stripe.
  a. General colour suffused with yellowish . 1. *macclellandi*, Horsf.
  b. Colour lighter, greyer, stripes distinct . 2. *m. manipurensis*, Bonh.
B.—Three black dorsal stripes ... ... 3. *m. barbei*, Bl.

DISTRIBUTION :—

1. *T. macclellandi*, Horsfield. *Type locality* :—Assam. (McClelland).
Other localities :—Sadiya, Assam ; Nepal ; Sikkim ; Bhutan (B. M.) ; Sikkim ; Darjiling ; Chindwin (M. S. I.).
Co-types :—B. M. Nos. 79.11.21. 372 and 373.
Lectotype :—B. M. No. 79.11.21. 372.

2. *T. macclellandi manipurensis*, Bonhote.	*Type locality* :—Aimole, Manipur. (Hume). *Other localities* :—Manipur (Hume). (B. M.); Chin Hills (Mackenzie) (M. S. I.). *Type* :—B. M. No. 85.8.1.273.
3. *T. macclellandi barbei*, Blyth.	*Type locality* :—Ye, Tenasserim (Rev. J. Barbe). *Other localities* :—Tavoy; Tenasserim (B. M.); Tenasserim (M. S. I.). *Co-types* :—Ind. Mus. Calc. Nos. *c—d*.

(To be continued.)

ON ASIATIC STARLINGS.

BY

CAPT. C. B. TICEHURST, R.A.M.C.

Mr. Kinnear, our Museum Secretary, has asked me to write some notes on the Starlings which are, or might be, found in India and Mesopotamia and I must preface my paper on this subject with the remark that this paper contains nothing very new or original and is simply written as a guide to those out in the East, who may find some difficulty in identifying the various races of Starlings they may come across*.

The Group of Starlings (*Sturnus*) are most interesting and at the same time rather a difficult one to elucidate and in India a good deal of misconception exists concerning them. This is no doubt due to the way in which they are dealt with in the "Fauna of British India." Here Oates raised all the Starlings to the rank of species, whereas their true status is, in my opinion, only that of sub-species or geographical races of the European Starling, (the first to be described, Linnans 1758). Moreover in the Fauna the nomenclature is somewhat muddled, the descriptions under what is called Finsch's Starling (*Sturnus poltaratskyi*) applies to the *Sturnus nobilior* of Hume, while *poltaratskyi* of Finsch (1878) is the correct and oldest name for the common Indian Starling, which is there called *Sturnus menzbieri* of Sharpe (1888), the latter being a synonym.

In general appearance and in the field all the Starlings look alike and it is impossible to differentiate them except in the hand.† The chief differences lie in the distribution and character of the varied metallic reflexions of the feathers. I have heard it stated that such differences are of no value as the colour of the sheen varies according to the direction of the light and the way in which the bird is held. Of some sheens this is undoubtedly true—and in other birds than Starlings—but it is a primary maxim in all scientific work always to compare two or more things which are strictly comparable and it will be found that if these Starlings are placed under similar conditions, their varied sheens are pretty constant in character for each subspecies, and the correct way is to hold the bird with the bill towards one and with the light coming from in front.

I will now try and give shortly the distinguishing character of each and their approximate distribution, and as the question of birds from Mesopotamia concerns many who are interested in Ornithology out in the east I have included all the known races of *Sturnus vulgaris* likely to be found in Asia.

1. *Sturnus vulgaris poltaratskyi*, Finsch. The Common Indian Starling.

This is, *Sturnus menzbieri* of the Fauna.

Head, throat and ear coverts purple ; mantle and rump green ; upper tail coverts and scapulars green, the longest feathers often violet blue at the tips ; wing coverts green, mixed with violet-blue on the larger feathers ;

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* Several other forms have been described, of the validity of these I cannot personally speak, as I have seen no specimens, but since this paper has been written I have seen a resumè of some of these and I have added notes about them and others taken from Dr. Hartert's paper Novitates XXV, pp. 327-337. (1918)

† At the same time it must be noted that one can in good sun light with glasses often pick out males with purple wings, backs or heads from those with geren reflections in these parts, and early in the winter one can with fair certainty pick out adult males of *nobilior* from *poltaratskyi* by the blacker appearance, due to the finer and less amount of spotting of the underparts.

a green pectoral band separates the purple throat from the rest of the underparts which are "blue bottle" blue and more violet-blue on the flanks. Under wing coverts brown with broad buff edges. Wing 124-135 mm. Bill 24-27 mm. from forehead feathers.

This is the breeding bird of Siberia—Krasnoyarsk to Mara-kul and Saissan Nor and east to Lake Baikal (Hartert). Winter visitor to Himalayas as far east as Assam, and to the plains as far south as latitude of Baroda; stragglers are recorded from the Deccan and Madras. (Oates.)

2. *Sturnus vulgaris nobilior*, Hume.

This is the *Sturnus poltaratskyi* of the 'Fauna.'

Resembles *poltaratskyi*, but the belly and flanks bright reddish purple, *as also are the wing coverts*. The under tail coverts have a *purple* gloss. The scapulars rump and upper tail coverts are mostly green, sometimes mixed with purple blue, especially on the longer feathers. The underwing is *darker* with narrower *whitish* edges. In winter the spots are smaller and whiter. The bill is usually a little longer and slenderer, up to 30 mm.

Type locality. Kandahar, Afghanistan; probably breeds in Afghanistan and East Persia. Winter visitor to N. W. India, Sind and Punjab. (Hartert). Oates in the Fauna only gives three occurrences in India, *viz.*, Mardan, N. W. India and Munchar Lake in Sind, but it is certainly commoner than these records would imply.

3. *Sturnus vulgaris caucasicus*, Lorenz. The Caucasian Starling.

Not mentioned in the "Fauna" and not yet found in India.

Head, throat, ear coverts, mantle, rump, and under-tail coverts green; wing coverts, belly, and flanks deep red purple. Under-wing blackish brown with whitish edges.

Type locality, Kislowodsk. Breeds in Caucasus, mountains of Persia, south to Shiraz; in winter at Fao. (Hartert.)

4. *Sturnus vulgaris purpurascens*, Gould. Gould's Starling.

Head and neck green, back purple variable amount of violet or steel blue on mantle, wing coverts bronze, breast purple, abdomen bronze at sides. Underwing coverts blackish brown with pale rust coloured edges.

Type locality, Erzerum. Breeds in Asia Minor and Armenia exact boundaries unknown. Winters in Cyprus and Asia Minor. Has occurred as a straggler in the Punjab (Hartert). Oates gives Rawal Pindi and Gurgaon district as the only two occurrences but in view of the recognition of three new races (hereafter mentioned) these identifications of *purpurascens* in India may have to be altered (see note under *dzungaricus*).

5. *Sturnus vulgaris porphyronotus*, Sharpe. The Central Asian Starling.

Resembles *purpurascens*; the head is greenish but the ear coverts always more or less *purple*; the mantle is *red purple*, in some tinged with purple blue; the wing coverts are purple on the median and lesser series, bronze green on the secondaries and their coverts, and the purple of the belly shades off to *bronze green* on the flanks. Bill usually longer than in *poltaratskyi*; underwing blackish-brown with narrow whitish edges.

Hartert gives the wing measurement as 125-133, once 134, once 135, but I have seen it up to 137 mm.

Type locality, Yarkand. Breeds in Yarkand in Turkestan across Tian-Shan to Lake Issik Kul and Semiretshensk. In winter visits Afghanistan, Kashmir, Punjab, Sind and parts of U. P. (Hartert).

6. *Sturnus vulgaris humii*, Brooks. The Himalayan Starling.

Head, deep purple-blue, redder purple on the throat, chin, and hindneck; ear coverts *deep metallic green*; mantle coppery red to bronze; scapulars deep green; rump and upper tail coverts belly and flanks bronze-green; upper wing coverts bronze-green to bluish green; pectoral band of copper red is continuous with the throat and passes to the green underparts. Underwing coverts blackish-brown with narrow whitish edges. Outer-edge of primaries often whitish. Wings shorter than in the other races except *minor*, 119—125 mm.

In the first winter plumage I think this race is more heavily spotted with white than in any other race.

Type locality, Kashmir. Breeds in the Himalayas from Kashmir to Nepal and in the N. W. Punjab. Spreads out to the plains of the Punjab in winter and has been obtained at Dinapore, Etawah and in Sind. (Oates) (see under *dresseri*).

7. *Sturnus vulgaris minor*, Hume. The Small Indian Starling.

This is a most interesting and very distinct little Starling; the whole head, throat and ear coverts green; whole of the rest of the upper parts including the wing coverts red purple; no distinct pectoral band, the green of the throat joining the purple breast which shades off to green on the belly and flanks. Under tail coverts purple.

The wing is shorter than in any other race and measures 110-118 mm.

Not only does this bird look smaller than the other Starlings but it acquires the *yellow bill* of the breeding season long before the other winter visitant Starlings do.

The bill too is slightly smaller than in most of the other races but is about the same as in small females of *poltaratskyi*; the tarsi and toes are slightly smaller.

Type locality, Larkhana in Sind. It is said to be strictly resident and breed in the eastern Narra district of Sind from about Rohri southwards and to extent east as far as Etawah. This last locality is added on the strength of three birds which Brooks shot at Loyah near Etawah on January 13th, 1872, but I think that this race is not a normal inhabitant of that district. Excluding island races of Starlings, *minor* is the most local and limited in distribution of all and very few Ornithologists have ever met with it. Judging from the accounts of the earlier writers—Hume, Brooks and Doig, &c.—this bird inhabits the canal system of Sind in or near cultivation where "kandi" (*Prosopis spicigera*) jungle abounds in which trees it nests, and a few miles from such canals you may search for it in vain; even in suitable places it seems to be very local. Considering then its extremely local distribution, it seems very unlikely that this bird should extend normally as far east as Etawah from which it is cut off by the vast Sind-Rajputana desert, and I think it probably that in very dry years in Sind it may migrate in winter partly or wholly and so reach eastwards to such localities.

8. *Sturnus vulgaris vulgaris*, Linnœus. The Common European Starling. Not mentioned in the "Fauna" and has not as yet occurred in India.

Head and throat purple, in very old birds, however, it is more or less green; ear coverts *always green*. Scapulars, rump and upper tail coverts green; mantle green but always with a purple bronze shimmer, wing coverts green, violet-blue on the longer feather, breast and belly green, flanks "blue-bottle" blue, under tail coverts green. Under wing coverts brown with wide pale rusty brown edges.

Type locality, Sweden. Breeds in Europe, except in Faeröe and Azores (where it replaced by island forms) and in S. E. Europe, where it replaced by other forms.

Sturnus vulgaris sophiae has been described by Bianchi. Apparently it only differs from *vulgaris vulgaris* by having more purplish colour on the head especially the crown and throat. It is said to inhabit Eastern Russia, wintering on the Talysh, passes through the Caucasus to Palestine, Cyprus and Egypt. I can only remark that a great many west European Starlings have, as indicated above, the head and throat purple and I cannot believe that *sophiae* is a good race.

Sturnus vulgaris oppenheimi was described by Neumann and is said to breed in northern Mesopotamia. It is evidently very close to *purpurascens* from which it is said to differ by having the head glossy green *with a purple base,* nape *steel blue,* back *blue* green and outer webs of secondaries and their coverts with a *bronzy gloss*; upperwing coverts, lower back and rump purple, underside more or less purple; the glossy green throat and the colour of the head, nape and rump would seem to distinguish this race too from *nobilior*.

Sturnus vulgaris dresseri was described by Buturlin. This race appears to be somewhat intermediate between *porphyronotus* and *nobilior*. It is said to differ from *porphyronotus* in having the head and throat *more purple*. Back, rump and upper tail coverts are more uniform purple but the mantle has "violet to steel blue and even dark green colours, in fact, the back is very variable and occasionally quite deep metallic green" (Hartert). This should distinguish it from *nobilior*. The wing too is said to be smaller, 11 specimens measure 125-131 mm.

The distribution, so far as is known, is to the N. and N. W. of that of *porphyronotus*. It ranges from Askabad and Merve to Ferghana, and according to Buturlin, east as far as Kara-tau. In winter not rare at Kandahar. In the British Museum there are specimens from Mardan and Sind (Hartert). Possibly this last may be that recorded by Oates from Sind as *humii;* this specimen requires re-examination as I know of no other record of *humii* from Sind.

Sturnus vulgaris dzungaricus is described by Buturlin who believes this race nests in Dzungaria. This race seems to be very near *nobilior* and *dresseri*. Hartert says that the birds he has seen are too large (wings 129-135) for the latter and the underwing coverts too light. As this race has occurred in India (according to Hartert who has examined birds from Meerut, Mardan, Lucknow, and Rawal Pindi), I append the distinctions he gives though I must confess that on paper they are very difficult to visualize.

"The head is green with a strong purplish gloss, or, as Buturlin says, 'bronze purple,' the back is purple, interscapular region, however with more or less steely-blue green, edges of the wings bronze with more or less purple gloss."

One of the above birds (the Rawal Pindi one, Biddulph coll.) was labelled by Sharpe as *purpurascens* (Fauna i, 524).

Sturnus vulgaris zaidamensis was described by Buturlin from 2 specimens from Zaidam and Ta-tschu, N. of Nansan Mts. It appears to resemble *poltaratskyi* but has a green head, neck and throat.

Two specimens are not sufficient to separate new races of Starlings on.

General Remarks.—From the above descriptions I think one should be able to name the majority of specimens; however in first winter dress when the plumage is very spotted and the glossy reflections masked, especially in females (which are always duller than males), considerable difficulty may be experienced and a few will be impossible to name. Very rough skins are difficult and sometimes impossible to differentiate as may be readily imagined when one realizes that the colour sheen depends on the reflection of light from the surface of the feathers.

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XVIII—(*continued*).

REPORT ON THE HOUSE RATS OF INDIA, BURMA, AND CEYLON.

BY

MARTIN A. C. HINTON.

PART II.

(*Continued from page 88 of this Volume.*)

7. *Rattus rattus wroughtoni*, subsp. n.

1912. *Epimys rufescens*, variety with white underparts, Wroughton, Report No. 5, Dharwar, *J. Bombay Nat. Hist. Soc.* xxi, p. 1189; Ryley, Report No. 9, Mysore, vol. xxii, p. 293; Report No. 11, Coorg, vol. xxii., p.

Type:—A male (B. M. No. 98.3.5.26; Original No. $\frac{97}{66}$) collected at Coonoor, Nilgiri Hills, on 25 December 1897, by Mr. R. C. Wroughton and presented by him to the British Museum.

Distribution:—Southern India; its range as at present known extending from Travancore and eastern Madura northwards to Dharwar and eastern Mysore.

Material examined:—4 (♂) from Coonoor, Nilgiri Hills; 8 (4 ♂, 4 ♀) from Travancore; 1 (♂) from eastern Madura; 12 (4 ♂, 8 ♀) from South Coorg; 12 (5 ♂, 7 ♀) from North Coorg; 13 (9 ♂, 4 ♀) from southern and eastern Mysore; 13 (8 ♂, 5 ♀) from northern Mysore and Kanara; and 12 (7 ♂, 5 ♀) from Dharwar (South Mahratta). Total 75 (39 ♂, 36 ♀).

Description:—This race differs apparently from *arboreus*, *narbadæ*, *girensis* and *sataræ* in having the body larger, the head, tail and ears relatively shorter.

The fur is usually thick but rather short; intermixed with it, particularly upon the back and flanks immediately behind the shoulders, are short, weak, spiny bristles in greater or less profusion. These bristles are whitish in colour; in some specimens they are not sufficiently abundant to affect the general quality of the pelage, but more frequently they are very numerous and render the fur quite harsh to the touch.

The general dorsal colour is much more nearly rufous than in any of the other Indian subspecies. The ground colour of the back is a light reddish brown and it is lined with a greater or less number of long black hairs; as in other races (*cf.*, p. 87), these black hairs seem to be gradually eliminated by bleaching, so that older specimens have their backs of a purer or clearer red-brown than younger examples. The belly is pure white or cream-coloured; the ventral hairs are usually white to their bases everywhere. The feet are light, whitish or yellowish, above. The tail is unicoloured, its hue varying from a light brown to dusky. The mammæ were counted in 20 females; in 19 the formula is 2-3=10, in one 3-3= 12.

The following are the dimensions of the more important specimens:—

COONOOR, Nilgiri Hills (6,000'); collected by Mr. R. C. Wroughton; B. M. serial No. 98·3.5—

·22 97— ♂, 11 December 1897 185—218—33—23.
·24 97— ♂, 13 ,, ,, 154—199—30—22.
·25 97— ♂, 16 ,, ,, 164—200—32—21.
·26 97—61 ♂, 25 ,, ,, 187—215—34—22 (TYPE).

TRAVANCORE (received from the Trivandrum Museum; B. M. serial No. 95.10.9.—)—

Poumudi (2,000').—
.39 ♂, 4 Jan. 1895 171—219—33.
.30 ♂, 12 Apr. ,, 178— —30.
.33 ♀, 7 Mar. ,, 172—213—35.

Trivandrum—
.34 ♂, 12 Dec. 1894 180—190—32.
.35 ♀, 30 ,, 1895 155—200—32.

Seenakala—
·36 ♂, 5 Jan. 1895 180—190—32.

Eastern MADURA (Marengan, near Saemenep; B. M. No. 10.4.7):—

.19 2168 ♂, 5 Nov. 1909 185—200—37—20

SOUTH COORG, Wotekolu (2,000'); collected for the Mammal Survey by Mr. G. C. Shortridge (B. M. serial No. 13.8.22.—):—

.73 2316 ♀, 17 Jan. 1913 195—258—35—24.

North Coorg, Halery Estate (3,555')—

.72 2177 ♂, 19 Dec. 1912 193—220—32.5-22·5.

SOUTHERN AND EASTERN MYSORE; collected for the Mammal Survey by Mr. G. C. Shortridge; B. M. serial No. 13.4.11:—

Seringapatam (2,338')—
.97 1971 ♀, 19 Oct. 1912 175—214—32—22

Bangalore (3,113')—
.84 1693 ♂, 3 Sept. 1912 174—197—33—21. Weight 4¾ oz.
.87 1715 ♀, 7 ,, ,, 191—230—34—24.

Kolar Town (2,786'—4,026')—
.89 1779 ♂, 19 Sept. 1912. 176—205—35—22.
.90 1781 ♂, 19 ,, ,, 164—212—33—21.5
.91 1846 ♂, 23 ,, ,, 201—232—35—22·5
.92 1766 ♀, 19 ,, ,, 189—225—35—22.
.93 1782 ♀, 19 ,, ,, 169—200—32·5-21.

Northern Mysore & Kanara; collected for the Mammal Survey by Mr. G. C. Shortridge; B. M. serial No. 12.11.28.—

Sagar, Shimoga District (2,500′)—
.117 ♀, 8 June 1912 193— 32—23
.111 ♀, 13 ,, ,, 160—198—32—20.5· Weight 2⅝ oz.
Kardibetta Forest, Shimoga District (2,500′)—
.112 1318 ♂ 21 June 1912 160—210—33.5-22· Weight 3¾ oz.
.113 1333 ♂ 25 ,, ,, 182—250—36—25 ,, 5⅜ ,,
.114 1320 ♀ 21 ,, ,, 170—237—33—22 ,, 4⅞ ,,
Gersappa (sea-level)—
.115 1194 ♀ 26 May 1912 177—246—35—22· Weight 5½ oz.
.116 ♀ 31 ,, ,, 169—217—34—21

South Mahratta; collected for the Mammal Survey by Mr. G. C. Shortridge; B. M. serial No. 12.6.29—

Dharwar (specimens collected by Mr. C. Hudson, 1907; B. M. 7.11)—
.22.33 ♂, 7 Sept. 1907 159—160—31—21.
.30.3 ♂, 17 Oct. ,, 154—176—32—22.
.30·4 ♂, 17 ,, ,, 168—190—33—21.
.99 ♂. 30 ,, 1911 150—181—31—23.
.101 ♂, 31 ,, ,, 146—178—33—21.
.22.35 ♀, 7 Sept. 1907 175—200—33—23.
Hubli (2,200′)—
.102 ♂, 31 Dec. 1911 165—194—32—22·5

Average of 78 adults (head and body ranging between 140 and 204):—

170—207—33·1—12·8 = 100—122—19·5—12·8.

The following table shows the changes in proportions at different stages of growth:—

Head and body. mm.	No. of specimens.	Average per cent. of head and body length formed by H. & B. Tail. Hind-foot. Ear.
78 to 81	2	100—121—29·9—19·5
134	1	100—136—25
140 to 149	5	100—130—23·2—14·6
150 to 159	12	100—121—20·5—13·6
160 to 169	20	100—124—20·3—13·1
170 to 179	23	100—122—19 —12·7
180 to 189	10	100—118—18·7—12·4
190 to 195	6	100—121—17·3—11·7
200 to 204	2	100—106—16·8—11·3

In calculating the above averages use has been made of some of the measurements recorded by Lloyd (Rec. Indian Mus. iii, p. 60).

The skull shows a considerable range of variation as regards size, the condylo-basal length in specimens with the teeth in a half-worn condition ranging between 36 and 43·2, the average of 20 being 38·6. As regards proportions and form it is quite indistinguishable from the skull of *R. r. narbadæ.*

Local variation :—The material available is quite insufficient for any attempt at working out in detail the geographical variation of the species in this region. The quality of the pelage appears to vary with the individual, although it may also depend largely upon age, sex, and season. As regards dorsal colour the rats from Travancore, the Nilgiris and Coorg are the brightest and reddest: while those from more northerly stations, as Dharwar, tend to be duller and browner. Specimens from South Coorg and from the Kardibetta Forest have the tails relatively much longer than they are in those from the other districts.

Remarks :—Taken as a whole the white bellied rats of Southern India distinguish themselves from the races of Bengal and the Central Provinces by their redder backs and by their relatively shorter tails and ears. I am not able to refer them to any of the races described above and although conscious of the fact that the material from the extensive region just covered shows a considerable range of variation, I propose to establish a new subspecies for their reception. The Nilgiri specimens, collected long ago by Mr. Wroughton, may be regarded as typical; and the subspecies may most fittingly be called *R. r. wroughtoni.*

8. *Rattus rattus kandianus*, Kelaart.

1850. *Mus kandianus*, Kelaart, *J. A. S. Ceylon*, vol. II., p. 326.
1915. *Epimys kandianus*, Wroughton, *J. Bombay N. H. Soc.*, vol. XXIV., p. 49. (Full synonymy in Wroughton's paper just cited.)

Type :—A specimen from Newera Eliya, presented by Dr. Kelaart to the British Museum (No. 52.5.9.26), exactly corresponds with the original description and has been selected by Wroughton as the lectotype. The lectotype is accompanied by two other specimens presented by Dr. Kelaart (Nos. 52.5.9.24 and 25) and labelled as co-types of *kandianus*; but these as pointed out by Wroughton are referable to *R. kelaarti*, Wroughton.

Distribution :—This is common throughout Ceylon, where it ranges from the sea-coast up to the highest altitudes.

Material examined :—In addition to Kelaart's specimens I have studied 59 (of which about 50 are adult) from various parts of the island and all obtained by the Mammal Survey.

Description :—In general outward appearance, and in its short and frequently spiny fur, this subspecies is much like *R. r. wroughtoni*; it is distinguished from the latter by its relatively longer tail (averaging 132 instead of 122 per cent. of the head and body length). The dorsal colour is a bright rufous brown, separated by a sharp flank line of demarcation from the pure white or cream belly. The latter sometimes has a distinct yellow tinge, which occasionally deepens to orange; in one specimen, a bright band of orange extends across the throat on to the fore limbs. The ventral hairs are usually light coloured to their bases, but sometimes on the chest, or along the mid-ventral line, some have slaty bases. The feet are usually white or light yellowish brown above. The tail is unicoloured and light brown. The females have 10 mammæ.

Some specimens from Udugama (S. P.) have dark backs, soiled bellies, and darker feet (in one quite dusky) than usual. These at first sight look like *kelaarti*; but their fur is short, harsh and spiny, and I have no doubt they are correctly referred to the present form.

The following are the dimensions of the specimens whose skulls were specially examined:—

15.3.1.189	♀,	3 April	1913	174—195—30—21	Colombo.
.190	♂,	21 ,,	,,	174—190—32—20	Udugama.
.191	♂,	30 ,,	,,	180—246—35—23·5	,,
.193	♀,	30 ,,	,,	175—237—28·5–23	,,
.202	♀,	14 July	,,	129—195—30—20	Kambukken.
.205	♂,	6 Aug.	,,	168—193—31.5—21.5	Maha Oya.
.215	♂,	11 Feb.	1914	178—210—33.5—21	Kandy.
Average of 28 adults:—				153—202—31·4—21·2	
Do. % of H. & B. length;—				100—132—20·5—13·9	

The 59 Survey specimens give the following growth table;—

Head and body length mm.	No. of specimens.	Average per cent. of H. & B. formed by H. & B. Tail. Hind-foot. Ear.
96—117	6	100—141—25·7—16·8
120—129	5	100—141—23·7—15·6
130—139	11	100—133—22·8—14·7
140—149	13	100—132—21·4—14·2
150—159	13	100—128—20·3—13·6
160—169	5	100—118—19·4—12·6
170—180	6	100—121—18·2—12·2
96—180	59	100—130—21·2—14

The skull does not differ from that of *R. r. wroughtoni*.

Remarks:—*R. r. kandianus* cannot be said to be sharply differentiated from *R. r. wroughtoni*; it does not seem ever to attain the large dimensions reached by some of the mainland specimens, and its tail is relatively longer. As it has received a name and is an island form, it is convenient to continue to regard *kandianus* as distinct, at all events until a similarly good series of specimens comes to hand from the south of India.

9. *Rattus rattus gangutrianus*, subsp. n.

1914. *Epimys rufescens*, variety with white underparts, Wroughton, Report No. 15, Kumaon. *J. Bombay Nat. Hist. Soc.*, xxiii., p. 295.

Type:—A male (B. M. 14.7.10.127; Original No. 4258) collected at Ranibagh, Naini Tal, on 25 December 1913, by Mr. C. A. Crump for the Mammal Survey; presented to the National Collection by the Bombay Natural History Society.

Distribution:—Kumaon; at altitudes ranging from 1,100′ to 7,650′.

Material examined:—14 (5 ♂, 9 ♀) from Ramnagar (1,100′); 4 (1 ♂, 3 ♀) from Dela, Ramnagar (1,500′); 1 (♀) from Jerna, Ramnagar (1,500′); 10 (6 ♂, 4 ♀) from Sitabani (2,000′); 2 (♂) from Ranibagh, Naini Tal (2,500′); 7 (5 ♂, 2 ♀) from Ratighat (3,800′); 7 (5 ♂, 2 ♀) from Takula (5,350′); 8 (3 ♂, 5 ♀) from Almora (5,500′); 33 (13 ♂, 20 ♀) from Lohaghat, Almora (5,600′); 2 (♂) from Bhowali, Naini Tal (5,700′); 1 (♂) from Naini Tal (7,000′); 8 (2 ♂, 6 ♀) from Khati, Pindar Valley (7,650′); 5 (4 ♂, 1 ♀) from Lwarket (6,000′); 4 (2 ♂, 2 ♀) from Bageswar (3,200′). Total 106 (51 ♂, 55 ♀). All collected by Mr. C. A. Crump for the Mammal Survey; those presented to the British Museum have been registered under the serial number 14.7.10.

Description:—This well marked subspecies attains a larger size than do those dealt with above; the head and body length ranges between 130 and 187 mm.—specimens measuring from 150 to 170 being most numerous. The tail is relatively shorter than in the lowland forms, the difference being most marked in younger stages of growth.

Typically the fur is dense, long and soft, rarely developing spines. The dorsal coloration is far colder than in the hill races of Sikkim and considerably lighter as a rule than in the lowland subspecies *narbadæ* and *girensis*. Usually the ground colour of the back and flanks is a light but cold grey or yellow and it is lined with a variable number of long black hairs; the latter are most abundant along the mid-dorsal line, especially towards the rump, where they not infrequently form a noticeable black stripe which extends on to the root of the tail. The bellies are very softly furred, pure white as a rule, but sometimes tinged with pale yellow, and always sharply and regular contrasted with the dark flanks. The majority of the ventral hairs are light coloured to their bases; but on the chest and along the mid-ventral line they have, in many specimens slaty bases and/or are tipped with buff, so that a more or less obvious yellowish pectoral stripe and collar may be developed. Bright ochraceous hairs are frequently developed around the genitalia. The tail is usually more pallid than in the other subspecies, its colour being a light brown amounting sometimes to little more than dirty white; sometimes, but usually in young specimens, it is comparatively hairy and very slightly paler below than above. The feet are light above, almost white, but frequently showing dusky markings in old individuals. The not inconsiderable variations of colour perceptible in this subspecies are noticed below under Local Variation; in part they have a local value, but in part they appear to be connected with differences of age or development.

The mammæ were counted in 22 females; in 18 the formula is 3-3=12 while in 4 only is it 2-3=10.

The following are the dimensions of the more important specimens:—

Ranibagh, Naini Tal (2,500′)—

.126 4225 ♂, 24 Dec. 1913 182—229—36—25. Weight 6¼ oz.
.127 4258 ♂, 25 ,, ,, 183—228—35—25. ,, 6¼ ,,

Ramnagar (1,100′)— (Type).

.116 4047 ♂, 5 Dec. 1913 177—224—34—25 ,, 5½ oz.
.117 4066 ♂, 7 ,, ,, 164—211—35—25 ,, 4½ ,,
.118 4156 ♀, 13 ,, ,, 163—218—34—22 ,, 4½ ,,
.119 4159 ♀, 13 ,, ,, 165— 34—24

Dela, Ramnagar (1,500′)—

.128 4273 ♀, 6 Jan. 1914 162—222—34—25

Sitabani (2,000′)—

.132 3959 ♂, 20 Nov. 1913 166—204—33—22 Weight. 5½ oz.
.133 3987 ♂, 24 ,, ,, 187—241—37—28 ,, 6¾ ,,
.134 3971 ♀, 20 ,, ,, 157—202—33—23 ,, 4½ ,,

Ratighat (3,800′)—

.129 3917 ♂, 31 Oct. 1913 161—214—34—23
.130 3921 ♂, 1 Nov. ,, 157—212—33—22. Weight 4½ oz.
.131 3923 ♀, 2 ,, ,, 168—213—33—24 ,, 5 ,,

Takula (5,350′)—

.124 3855 ♂, 12 Oct. 1913 179—221—34—26. Weight 6½ oz.
.125 3841 ♀, 9 ,, ,, 170—208—33—24

Lohaghat (5,600′)—

.121 4363 ♂, 5 Feb. 1914 159—196—31—23. Weight 5¼ oz.
.122 4366 ♀, 5 ,, ,, 150—196—32—22

Khati (7,650′)—
.111 3700 ♂, 9 Sept. 1913 160—189—32—23. Weight 5 oz.
.112 3573 ♀, 22 Aug. ,, 162—187—29—23
.113 3691 ♀, 8 Sept. ,, 173—211—32—25 ,, $5\frac{1}{4}$,,
.114 3692 ♀, 8 ,, ,, 158—188—30—22 ,, 4 ,,
.115 3701 ♀, 9 ,, ,, 170—200—33—25 ,, 5 ,,
Lwarkhet (6,000′)—
·123 3782 ♂, 24 Sept. 1913 163—208—34—25. Weight 6 oz.
Average of 105 adults from Kumaon—157—195—32·5—23·4
,, % of head and body = 100—124—20·7—14·9

The following table shows the variation in the proportions at successive stages of growth :—

Head and body. mm.	No. of specimens.	Average % of head and body length formed by H. & B., Tail, Hind-foot, Ear.
130 to 139	8	100—125—23 —16·4
140 to 149	19	100—124—22·2—15·8
150 to 159	34	100—123—20·8—14·9
160 to 169	32	100—126—20·1—14·4
170 to 179	12	100—121—19·1—14·3
180 to 187	3	100—126.5-19·6—14·1

It would appear from this table, that, as in *R. r. tistæ*, the tail is relatively much shorter in younger or smaller individuals than it is in the corresponding stages of growth of the lowland subspecies; and further that its relative length does not decrease so rapidly or regularly with growth or increased size as in lowland forms.

The skull is large (average condylo-basal length 40·8), agreeing in this respect and in cranial and intertemporal breadths with *R. r. alexandrinus*. The temporal wings of the parietals are large, their lengths being equal to at least half the full length of the squamosals; the parietals articulate with the supraoccipital above the temporal lines by means of broad tongues. The nasals are distinctly larger; the palatal length of the anterior palatal foramina, the width of the masseteric plate and the length of the tooth-row are distinctly greater relatively than in the European races. The post-molar length is shorter relatively, and this seems to be due to a shortening of the pterygoid fossæ.

The skull is distinctly larger than in any of the subspecies described above and the proportional measurements given in Table II sufficiently bring out the many small points of difference between them.

Local variation :—In his report upon the Kumaon collection (*op. cit.*, p. 296) Mr. Wroughton remarks that "the coloration at several, especially of the higher, stations, is extraordinarily constant for each locality, while noticeably differing from that of other stations". This is perfectly true. But on studying these rats closely it becomes apparent, moreover, that at each locality the coloration of the adult pelage is affected by a series of changes, which, whether produced by gradual replacement of hairs, by bleaching, or by a combination of both processes, seems to be intimately connected with growth or size. Observations lead me to think that similar changes take place continuously in all the Indian subspecies of *R. rattus*.

In the series from Ramnagar a transition from a younger cold grey pelage, with numerous black hairs, to an older, brighter and yellow pelage may be observed. In 6 small rats (H. & B. 139-155) the tails are short, fine-scaled and slightly paler below than above; the feet in 1 show a faint dusky mark, but in the others they are quite white above. In 6 large rats (H. & B. 164-177) the black hairs are rather abundant along the spines, but less numerous towards the flanks; in these the ground colour varies from grey, through brown, to light yellow, but it is always distinctly warmer in tone than in the dark bellied "*rufescens*" from this locality. In 3 of the large specimens the hairs on the chest and mid-ventral line have slaty bases and more or less evident buff tips. The feet are whitish in all; and purest in those specimens in which *all* the ventral hairs are white throughout.

In all the specimens from Sitabani the fur is soft and long; the bellies pure white, save for a small spot on the chest where, in several individuals, the hairs have slaty bases. In 6 (H. & B. 138-152) the dorsal ground colour is greyish yellow and is rather extensively darkened by black hairs; in all the feet are white above without dusky markings. No. 3971 (H. & B. 157), with moderately worn teeth, has the back and feet as in the small or immature specimens. No. 3986 (H. & B. 164) has rather more yellow and less black on the back and its feet show a faint dusky mark. No. 3969 (H. & B. 166) is still brighter and the dusky mark, particularly on the right foot, is more distinct. Lastly No. 3987 (H. & B. 187), a very old specimen, has the back of a cold grey mottled with a good deal of greyish black; the feet show a distinct dusky stripe above.

The long series from Lohaghat is really very uniform. The ground colour of the back varies between greyish and yellowish brown, more or less darkened along spine and over the rump by black hairs; the latter show some tendency to form a median stripe towards the tail-root. The under-parts are usually pure white to the hair bases, but a small chest spot of slaty based hairs is frequently present. In several there are faint indications of a mid-ventral stripe of buff; and in some of the specimens the whole ventral surface is suffused with pale lemon or bright buff. The feet are greyish white in most, but sometimes they are lightly tinged with yellow. The tails are dark and unicoloured.

In 5 of the specimens from Takula (H. & B. 144-171) the backs are much darkened by numerous black hairs. One of them, No. 3846 (H. & B. 161), has a pale line, convex backwards, curving across the shoulders and looking as though it had been produced by a bleaching of the hair tips; another No. 384 (H. & B. 170) is noticeably paler over the head and shoulders than behind. No. 3855 (H. & B. 179), the largest specimen of this series, is paler than any of the others and as regards colour falls well into line with the Lohaghat series.

All the specimens from Kumaon, except those mentioned below, are soft furred rats and although they vary locally to some extent in colour and size they are all clearly referable to one subspecies. In working through the collection I have received the impression that the dorsal coloration of adults passes regularly through the following sequence of changes:—the backs are at first dull greyish black; then the ground colour changes from cold grey to bright yellow and the blackness of the long hairs appears to become more intense; next bleaching of the hair tips starts on the head on shoulder, and the black hairs apparently become confined to the rump; lastly the bleaching extends over the whole dorsal surface which tends to become of a uniform yellow-brown. Some such sequence of changes seems to apply to other subspecies also, *e.g.*, *arboreus* and *narbadæ*.

It is very difficult to decide whether these changes are connected simply with growth and advancing age, or whether they follow upon each renewal of the coat. I can only leave the matter to future investigation with the following inconclusive statement:—The occasional occurrence of small rats with yellow-brown backs and of large, and in some cases undoubtedly very old, rats with cold grey tints seems to imply that these changes take place as often as the coat is renewed and therefore that the cycle is repeated often in the life-time of the individual. On the other hand the whole collection before me shows clearly enough that cold grey and yellow-brown are the prevailing tints of small and large rats respectively.

The specimens collected by Mr. Crump at Khati and Lwarkhet, the two highest stations at which rats of this species were found, are of great interest. They are distinguished from those of most of the lower stations by having short, harsh and sometimes spiny fur. The dorsal colour is a warm brown, about as in brighter examples of "*rufescens*". The bellies are white or yellowish; and in some specimens many of the rather long and rough ventral hairs have slaty bases. The feet are light brown with occasional dusky markings. The skulls are noticeably smaller than in typical *gangutrianus*, the condylo-basal length in 5 from Khati ranging between 36·4 (teeth moderately worn) to 39·4 (teeth much worn); but they do not differ in form or proportions from those of the lower stations. The females also are usually 12-mammæd. I have been much puzzled by these rats; but I am not able to convince myself that they are subspecifically distinct from *gangutrianus*. The specimens taken at Bageswar closely resemble those from Khati in external appearance; but they have the skull as large as in those from Almora and Naini Tal. On the other hand the soft-furred, cold tinted rats of Lohaghat have skulls as small as those from Khati. Further, while 12 of those from Ramnagar, the lowest station of all yielding white bellied rats, resemble typical *gangutrianus* in colour and pelage, 2 others from this locality are almost indistinguishable from the Khati series. It would seem therefore that all must be referred to one subspecies, which, like all other forms of *rattus*, has a very plastic constitution and shows a well marked tendency to produce peculiar local races wherever segregation is possible.[1]

Remarks :—Typical *gangutrianus* is readily distinguishable from the soft-furred subspecies of Sikkim and Bhutan by its much more pallid dorsal coloration ; and from the lowland races *arboreus*, *narbadæ* and *girensis* by its much longer, denser and softer fur—particularly noticeable on the ventral surface. The presence of 12 mammæ instead of 10 in most of the females and the large size of the skull are features suggesting affinity with *R. r. sikkimensis* ; the temporal muscles however, are apparently weak as in most subspecies of *rattus* and the posterior region of the skull is correspondingly little modified.

10. *Rattus rattus sikkimensis*, subsp. n.

1916. *Epimys rufescens*, variety with white underparts. Wroughton, Report No. 23, Sikkim and Bengal Terai. *J. Bombay Nat. Hist. Soc.* vol. xxiv., p. 489 (in part).

Type :—A female (B. M. No. 17.7.2.46; Original No. 677) collected for the Mammal Survey by N. A. Baptista, on 1 September 1914, at Pashok, Sikkim (3,500′); presented to the British Museum by the Bombay Natural History Society.

Material examined :—24 (15 ♂, 9 ♀) from Pashok; 2 (♀) from Singhik; 2 (♂ and ♀) from Ringin; 3 (1 ♂, 2 ♀) from Rongli; 19 (9 ♂, 10 ♀) from Gopaldhara, Sikkim. Further 2 (♀) from Hazimara, Bhutan Douars; and possibly 1 (♀) from

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[1]. It is just possible that the difference in pelage between those from Khati and Lwarkhet on the one hand and those from most of the lower stations on the other may be seasonal. The collections from Khati, Lwarkhet and Bageswar were made between the end of August and the beginning of October ; those from the other localities between October and February.

Jalpaiguri, Bengal. Total 53 (26 ♂, 27 ♀); all collected for the Mammal Survey by Messrs. C. A. Crump and N. A. Baptista. Specimens presented to the British Museum have been mostly registered under the serial number 15.9.1.

Description:—This is a distinctly larger form than *R. r. tistæ* its companion at Pashok; the head and body averages 154 instead of 147; the ear 22.4 instead of 21.3; and the condylo-basal length of the skull 41.4 instead of 37.8. The tail is relatively longer, its average length being equal to 131 per cent. instead of 124 per cent. of the head and body measurement.

The fur is soft and thick on the back and flanks and does not show any tendency to become spiny; on the underparts it is long but with a peculiar, rather harsh appearance. The dorsal colour in the typical series is a dark olive-brown, quite like that of *R. r. tistæ* from the same locality. The belly is pure white or cream coloured; the ventral hairs being white or cream to their bases. The lateral lines of demarcation are sharp and regular. The hands and feet are greyish or yellowish white above, with or without more or less obscure dusky markings. The tail is unicoloured and dusky. The mammary formula of the females is apparently constantly 3—3=12.

The following are the dimensions of the more important specimens from Pashok:—

236 ♂, 27 June 1915 146—190—33—23
286 ♂, 2 July ,, 160—208—31—22
502 ♂, 31 ,, ,, 170— 34—25
511 ♂, 1 Aug. ,, 172—222—34—24
645 ♂, 21 ,, ,, 174— 34—24
426 ♀, 21 July ,, 170—215—32—23
473 ♀, 26 ,, ,, 165—209—31—23
677 ♀, 1 Sept. ,, 174—217—32—24 (TYPE.)

Average of 24 adults with head and body ranging between 128 and 174:—

154—201—32.2—22.4 = 100—131—20.9—14.6.

The variation in the proportions with growth is as follows:—

Head and body. mm.	No. of specimens.	Average % of head and body length formed by H. & B., Tail, Hind-foot, Ear
128 to 139	4	100—142—24 —16.1
140 to 149	6	100—134—22.1—15
150 to 159	7	100—132—20.7—14.7
160 to 169	4	100—130—19.2—14
170 to 174	5	100—127—19.3—14

The skull is characterized by its large size (condylo-basal length averaging about 41 mm.), robust build and by features indicating a powerful development of the temporal muscles. While the cranial and occipital breadths are, in relation to the condylo-basal length, about as in European *rattus*, the least intertemporal distance is greatly diminished—being usually equal to considerably less than 30 per cent. of the condylo-basal length, or 70 per cent. of the cranial width. The temporal lines are in contact with the interparietal, so that the parietals have no intertemporal articulation with the supraoccipital. The temporal wing of each parietal is large, its length being equal to at least half the full length of the squamosal. Minor differences in the proportions of the palate, tooth-rows and bullæ, will be best appreciated from the comparisons made in Table II.

Local variation:—This subspecies appears to be rather widely distributed in Sikkim; specimens were obtained by the Survey from Singhik, Ringin, Rongli and Gopaldhara, as well as from Hazimara (Bhutan), in addition to the type locality. The specimens from each locality are usually very uniform among themselves, but often they are more or less readily distinguishable from those from the other localities by various peculiarities of colour and pelage. The cranial characters, large size and the presence of 12 mammæ in the females prove to be very constant features everywhere.

SINGHIK (4,600′)—

5885 ♀, 8 Feb. 1914 145—181—31—22
·145 5886 ♀, 8 ,, ,, 168—188—32—24

These have rather brightly coloured backs and pure white bellies. The larger specimen shows 12 mammæ; its skull (condylo-basal length 39·5; teeth half-worn) is quite typical.

RINGIN (6,000′)—

·146 6222 ♂, 16 Jan. 1915 159—188—34—23· Weight 4 oz.
6223 ♀, 16 ,, ,, 131—163—31—21 ,, $2\frac{1}{4}$,,

These are very soft furred rats, with dark backs and pure white underparts; the feet are light with an obscure dusky stripe on upper surface. The skull of the male, although small (condylo-basal length 37·5; teeth nearly half-worn), is quite typical in form and proportions.

RONGLI (2,700′)—

·138 5857 ♂, 26 Nov. 1914 177—230—36—25· Weight 6 ozs.
5824 ♀, 21 ,, ,, 155—212—32—23 ,, $4\frac{1}{4}$,,
·140 5835 ♀, 23 ,, ,, 162—203—34—23 ,, 4 ,
Average of 8:— 150—192—32·7-22·6
Do. % 100—128—21·8-15·1

The dorsal colour is relatively dull in this series; the females 5824 and 5835 each show 12 mammæ. The skulls are quite typical in their large size and form.

GOPALDHARA (4,720′)—

The following are the dimensions of the most important specimens from this locality:—

64 ♂, 12 May 1915 175—231—35—22
108 ♂, 21 ,, ,, 190—237—34
61 ♀, 11 ,, ,, 166—210—33—25
65 ♀, 12 ,, ,, 169—208—32—23
96 ♀, 19 ,, ,, 143—189—32—23
138 ♀, 29 ,, ,, 151—194—29—22
Average of 19 adults:— 155—200—32·2-22·1
Do. % 100—129—20·8-14·3

Twenty collected at this locality give the following growth table:—

Head and Body. mm.	No. of specimens.	Average % of head and body length formed by: H.B., Tail, Hind-foot, Ear.
110	1	100—139—27.3—18.2
134 to 139	2	100—127—22.3—15
140 to 149	5	100—128—22.4—15.2
150 to 158	7	100—131—20.3—14.5
162 to 169	3	100—128—20.2—13.9
175	1	100—132—20 —12.6
190	1	100—125—17.9

This series differs very noticeably from the typical *R. r. sikkimensis* from Pashok in having the backs distinctly rufous and the feet rather lighter; in other respects, *e.g.*, pure white bellies, the presence of 12 mammæ in the females, and the cranial characters, there is the closest agreement. If *sikkimensis* could have been specifically distinguished from *rattus*, then the Gopaldhara form might well have been treated as a distinct subspecies of the former.

HAZIMARA, BHUTAN (500′)—

1064, ♀ 5 Nov. 1915 163—220—33—24
1391, ♀ 13 Jan. 1916 170—225—32—25

Of 111 specimens of *R. rattus* collected at this locality these 2 pure white bellied females alone represent *R. r. sikkimensis.* They are distinguished from *R. r. bhotia* by their large size and the presence in them of 12 mammæ. The skull of 1064 was specially examined and found to agree perfectly with that of typical *sikkimensis* and to be very different from the other skulls from Hazimara; the circumstance that its teeth were heavily stained with black, while those of the skulls of *bhotia* were unstained, suggests that possibly *sikkimensis* is addicted to a special diet at Hazimara.

Jalpaiguri, Bengal (200′) ?

A skull (B.M. 15.9.1.155), labelled as belonging to the female of a pair collected at this place, is clearly referable to *sikkimensis.* The two skins and the male skull (15.9.1.154) show the Jalpaiguri animal to be a 10 mammæd form much like *R. r. bhotia* in character; and I do not think the skull .155 can belong to either skin. Possibly some confusion in labelling has taken place.

11. *Rattus rattus khyensis*, subsp. n.

1914. *Epimys rufescens*, var. with white underparts, Wroughton, Report No. 14, *J. Bombay Nat. Hist. Soc.* vol. xxii., p. 722; Report No. 16, *Journ. cit.*, vol. xxiii., p. 474; Report No. 20, *Journ cit.*, vol. xxiv., p. 307; (*Rattus*) Report No. 25, *ibid*, p. 771 (in part).

Type:—A female (B. M. No. 16.3.26.57; Original No. 251) collected on 29th March 1915 on the Chin Hills at a point 25 miles west of Kindat (altitude 600′) by Mr. J. M. D. Mackenzie; presented to the British Museum by the Bombay Natural History Society.

Material examined:—Chin Hills 10 (6 ♂, 4 ♀); Kin, Lower Chindwin, 3 (1 ♂, 2 ♀); North Shan States:—Gokteik 15 (3 ♂, 12 ♀) and Pyaungguang 13 (6 ♂, 7 ♀); Dry Zone:—Mount Popa 20 (11 ♂, 9 ♀) and Pagan 3 (1 ♂, 2 ♀); Pegu 5 (3 ♂, 2 ♀). Total 69 (31 ♂, 38 ♀). The whole of the material is due to the Mammal Survey:—

Description:—This is a bright coloured, red-backed and short tailed race, with the auditory bullæ considerably smaller than in *R. r. tatkonensis* described below.

In the typical series from the Chin Hills, the fur is short, thin and soft, being rarely mixed with soft spines or bristles. The dorsal colour is rufous, more or less conspicuously lined with long black hairs. The lines of demarcation along the flanks are sharply defined. The belly is pure white or cream, the ventral hairs being light to their bases; in two or three specimens, a weak mid-ventral longitudinal stripe formed by slaty hairs is present. The feet are dirty white. The tail is unicoloured, dark brown, and its length averages about 111 % of the head and body measurement. Even the youngest specimens before me may be distinguished from *R. macmillani*, the dusky species from the Upper Chindwin described below, by their red backs and far lighter feet. The females have 12 mammæ.

Specimens from the North Shan States—Gokteik and Pyaunggaung—closely resemble the typical series in all essential respects and they have similarly short tails. In many of them the dorsal fur is mixed with soft bristles or spines. In 9 the belly is pure white throughout; but it frequently shows a narrow pectoral stripe of slaty hue, and this is expanded in 5 to form a collar. In 5 others, many of the ventral hairs have slaty bases; and in 1, (No. 2965 ♂ from Pyaunggaung), all the ventral hairs have slaty bases, light tips and those in the middle line show the beginning of a median stripe of buff. Of 14 females examined 11 had 12 mammæ, 1 had 11, and 2 had 10.

The specimens from Mount Popa and Pagan have short, thin and relatively very spiny coats; their tails are rather longer, averaging about 120 per cent. of the head and body length. The average dorsal colour strikes me as being rather paler or yellower than in those from the Chin Hills and the North Shan States. The bellies are pure white or cream; and although 9 have a more or less evident trace of a pectoral slaty stripe, which spreads out anteriorly to form a collar in one specimen, they are much more uniform in ventral appearance than are those from Gokteik and Pyaunggaung. All the females examined show 12 mammæ.

The specimens from Pegu are also long tailed, the tail averaging 121 % of the head and body length. These perhaps are a little duller than in the typical series; the bellies vary from pure cream to dirty white. The females have 12 mammæ.

The following are the dimensions of the more important specimens :—

Chin Hills (B. M. serial No. 16.3.26.)—
.54 234 ♂, 28 Feb. 1915 183—194—34—22·5 weight 4 oz.
.55 244 ♂, 8 Mar. ,, 160—176—33·5-22·5 ,, 3½ ,,
.56 235 ♀, 12 ,, ,, 181—175—33·5-23 ,, 5 ,,
.57 251 ♀, 29 ,, ,, 166—184—32—22·5
North Shan States (B.M. serial No. 14.7.8.)—
·38 2741 ♂, 20 Apr. 1913 178—197—34—23 Gokteik.
.39 3043 ♂, 13 May ,, 195—222—35—24 6¾ oz. Pyaunggaung.
.40 3044 ♂, 13 ,, ,, 180—192—33—23 do.
.41 3046 ♂, 13 ,, ,, 166—181—32—23 do.
.42 2975 ♀, 6 ,, ,, 190—211—34.5-25 5¼ ,, do.
.43 2977 ♀, 6 ,, ,, 173—199—34—21 do.
.44 3045 ♀, 13 ,, ,, 158—168—31—21 do.
Average of 24 :— 168—186—32.8-22.9
,, % of head and body :—100—111—19.6-13.6
Mount Popa (B. M. serial No. 14.7.19.)—
.159 3520 ♂. 2 Sept. 1913 181—217—34—25
.160 3921 ♂. 29 ,, ,, 173—213—33—24
.161 3447 ♀, 29 Aug. ,, 160—200—33.5-23.5
.162 3459 ♀, 30 ,, ,, 170—222—33.5-22
.163 3751 ♀, 18 Sept. ,, 160—195—32—22

Average of 17 :—	164—198—32.2-22.1.
,, % of head and body :—	100—121—19.6-13.5
Pagan (B. M. serial No. 14.7.19.)—	
4041 ♂, 13 Oct. 1913	125—158—30—20
4162 ♀, 24 ,, ,,	153—189—30—20
4018 ♀, 12 ,, ,,	168—196—31.5-22
Pegu—	
568 ♂, 9 Feb. 1916	156—180—32—20·5
671 ♂, 1 June ,,	171—214—33—22
673 ♂, 17 ,, ,,	164—205—31—20
655 ♀, 13 May ,,	159—188—32—22
734 ♀, 4 Aug. ,,	162— —33—22
Average of 5 :—	162—197—32·2-21·3
,, % of head and body :—	100—121—19·9-13·2

The skull and teeth are of normal form; the cranial dimensions are given in the tables I (*e*) and II (*e*) in part III. The auditory bullæ are intermediate in size between those of *R. macmillani* and *R. r. tatkonensis* (see part III, tables II (*e*) and II (*h*)).

Remarks :—At first I was inclined to refer this form to Blyth's *Mus robustulus*. The type of the latter species has, however, been carefully described by Kloss recently (*Rec. Indian Mus.*, xiii., 1917, p. 6); the measurements of the skull given by Kloss appear to me to indicate that *robustulus* really belongs to an entirely distinct group.

12. *Rattus rattus tikos*, subsp. n.

1915. *Epimys rufescens*, variety with white underparts, Wroughton, Report No. 17, *J. Bombay Nat. Hist. Soc.*, vol. xxiii., p. 715.

Type:—A male (B. M. No. 14.12.8.168; Original No. 4934) collected on 13 March 1914 at Tenasserim Town by Mr. G. C. Shortridge; presented to the British Museum by the Bombay Natural History Society.

Material examined:—Tenasserim Town 6 (3 ♂, 3 ♀); Tenasserim Village 3 (1 ♂, 2 ♀); Banlaw 1 (♀); Tagoot 20 (13 ♂, 7 ♀); Thaget 5 (3 ♂, 2 ♀); Maliwun 4 (1 ♂, 3 ♀); Bankachon 12 (6 ♂, 6 ♀); Victoria Point 41 (22 ♂, 19 ♀); Victoria Island 4 (2 ♂, 2 ♀). Total 96 (51 ♂, 45 ♀); of these 59 may be regarded as fully adult.

Description :—This is geographically the most remote of the races of *R. rattus* described in this paper. It is apparently most closely allied to *R. r. khyensis*, from which it is distinguished principally by its dingier coloration, shorter tail and more variable mammary formula. As regards the shortness of the tail, it is most nearly approached by the typical specimens of *khyensis* from the Chin Hills; but as regards the variability in the mammæ, those from the North Shan States seem to foreshadow the present form.

The fur is short, moderately thick and frequently rather spiny. The general dorsal colour is dull, near "Prout's brown" or umber, lined with black; the belly is sharply contrasted with the flanks, pure white or cream in colour, and frequently developes a median pectoral longitudinal stripe of slate tint. The feet are light yellowish brown, more or less darkened above by dusky markings. The tail is unicoloured, dark brown, and averages about 108 $^{0}/_{0}$ of the head and body length. The mammæ are visible in 26 of the females; of these 8 only show the full formula of 3-3-12, 9 show 11, and 9 show 2-3-10; the variation is confined to the pectoral region, one of the post-axillary pairs being in course of reduction.

The following are the dimensions of the more important specimens :—

·167	4916	♂, 10 Mar.	1914	180—177—36 —23·5	6 oz.	Tenasserim Town.
·168	4934	♂, 13 ,,	,,	173—191—35.5-21·5	6 ,,	,,
·169	4926	♀, 12 ,,	,,	169—183—33 —19		,,
·170	4996	♂, 27 ,,	,,	168—179—32 —20		Thaget.
·171	5028	♀, 3 Apr.	,,	158—168—32 —21		,,
·164	4540	♂, 17 Dec.	1913	189— —35 —23		Bankachon.
·165	4417	♀, 7 ,,	,,	156—177—33·5-21·5		,,
·166	4660	♀, 31 ,,	,,	172—177—34·5-21		,,
·174	4246	♂, 26 Nov.	,,	161—181—35 —22	$5\frac{1}{8}$ oz.	Victoria Point.
·175	4247	♂, 26 ,,	,,	172—161—33 —21	$4\frac{5}{8}$,,	,,
·176	4260	♂, 27 ,,	,,	162—188—34 —21		,,
·177	4351	♂, 29 ,,	,,	160—183—33·5-20	3 ,,	,,
·178	4263	♀, 27 ,,	,,	160—176—34 —21		,,
·179	4364	♀, 30 ,,	,,	176—192—34 —22	$4\frac{7}{8}$,,	,,
·180	4366	♀, 30 ,,	,,	168—188—34 —21		,,
·181	4392	♀, 1 Dec.	,,	188—216—34 —23·5		,,
182	4375	♂, 30 Nov.	,,	174—200—37·5—23		Victoria Island.
·183	4376	♂, 30 ,,	,,	184—200—38—21	$5\frac{1}{4}$ oz.	,,
·184	4343	♀, 28 ,,	,,	167— —34—20·5		,,
·185	4378	♀, 30 ,,	,,	172—181—34—21		,,

Average of 59 adults :— 157—169—33·1-20.8

,, % of head and body :—100—108—21·1—13·2

The skull resembles that of *R. r. khyensis* in most respects including the size of the bullæ; it differs merely in being a little longer and narrower (see part III, table II (*e*)).

Remarks :—Mr. Shortridge (*J. Bombay Nat. Hist. Soc.*, xxiii., p. 715) states that he found this animal plentiful everywhere in Tenasserim, particularly around houses or near cultivation. He also called attention to the usually short tails and to the irregular number of the pectoral mammæ.

13. *Rattus rattus tatkonensis*, subsp. n.

1914. *Epimys rufescens*, variety with white underparts, Wroughton, Report No. 14, *J. Bombay Nat. Hist. Soc.*, vol. xxii., p. 722 ; Report No. 16, *ibid.*, vol. xxiii., p. 474 ; Report No. 20, *ibid.*, vol. xxiv., p. 307 (in part).

Type:—A male (B. M. No. 15.5.5.224 ; Original No. 5500) collected at Tatkon near Kindat, on the west bank of the Chindwin, by Mr. G. C. Shortridge and the late Captain S. A. Macmillan, on 26 June 1914, presented to the British Museum by the Bombay Natural History Society.

Material examined:—Chindwin River :—Tatkon 2 (♂) ; Kindat 1 (♂) : North Shan States :—Se'en 1 (♀); Hsipaw 1 (♂): Dry Zone :—Kyouk Nyoung 2 (♂ and ♀) ; Ngapyinin 1 (♀) ; Mingun 12 (6 ♂, 6 ♀). Total 20 (11 ♂, 9 ♀).

Description :—This is a rather short tailed, dull coloured rat, chiefly remarkable for the great size of its audital bullæ; by the latter character it is readily distinguishable from all its Burmese relatives.

The fur is short and thin, intermixed usually with numerous soft spines or bristles. The dorsal colour is always duller than in *R. r. khyensis*, and ranges from a dull reddish brown at the type locality to a dark greyish brown elsewhere. The bellies are pure white or cream coloured, separated from the flanks by sharp lines of demarcation, and with or without a slaty pectoral spot or stripe. The feet are dirty white above. The tail is unicoloured, dark brown, and averages about 120 $^{\circ}/_{\circ}$ or rather less of the head and body length. The mammary formula is 3-3-12 and is apparently constant.

The specimens from the banks of the Chindwin have the reddest backs ; those from Kyouk Nyoung and Ngapyinin have the backs dark brown, but without much black. Those from Mingun and Hsipaw form a very grey looking series, there being much black on their backs, lightened by numerous whitish spines, which show through the fur, while the reddish and yellowish tints are largely suppressed.

The dimensions of the principal specimens are—

Chindwin Valley (B. M. serial No. 15.5.5.) :—

Tatkon.
·224 5500 ♂, 26 June 171-209-34-22=100-122-19.9-12·9.
·225 5501 ♂, 26 ,, 156-206-36-22=100-132-23·1-14·1.
Kindat.
·229 5527 ♂, 12 ,, 153-184-32-24=100-120-20·9-15.

Irrawadi Valley (B. M. serial No. 14.7.9.)—
Kyouk Nyoung.
·164 3400 ♀, 29 July 184-232-33.5-25 = 100-126-18.2-13.6.
Ngapyinin.
·165 3416 ♀, 2nd Aug. 184-206-34-22. = 100-112-18.5-12.
North Shan States (B. M. serial No. 14.7.8.)—
Hsipaw,
·37 3138 ♂, 10 June 176-194-32-22 = 100-110-18.2-12.5 5¼ oz.
Mingun (B. M. serial No. 14.7.9·)—
.166 3240 ♂, 9 July 1913 187—220—34 —22
.167 3257 ♂, 10 ,, ,, 180—182—34.5—22.
.168 3276 ♂, 12 ,, ,, 187—182—33 —22.
.169 3242 ♀, 9 ,, ,, 173—194—32 —24.
.170 3277 ♀, 12 ,, ,, 172—188—32 —23.
Average of 11 adults :— 170—201—32.9—21.7.
,, % of head and body :—100—118—19.4—12.8.

The skull is chiefly remarkable for the large size of the audital bullæ; comparison in this respect with other Burmese forms is made in the subjoined table; the other cranial dimensions are given in part III in the tables II (*e*) and II (*h*).

Measurements of bullæ :—	Length.	Width (at lower edge of meatus).	Depth (from just above upper lip of meatus).
R. macmillani ...	6.7	4.6	6.4
R. r. khyensis ...	7.5	5	6.4
R. r. tatkonensis...	8.4	5.6	7.3

Dark bellied House Rats of India and Ceylon.

For reasons mentioned in the introduction to this paper, and in the descriptions of *R. r. narbadæ* and *r. girensis*, I share Mr. Wroughton's view that, unlike the wild white bellied races of *R. rattus*, the dark bellied House Rats of India and Ceylon are essentially parasites. In part, they seem to have arisen, by domestication, directly from the wild white bellied races of the country; in part, they are apparently the descendants of rats imported from abroad; and in part, they must be regarded as products derived from the interbreeding of the two classes just named. I devoted much time and trouble to an attempt to work out the exact relationship of the dark bellied rats of each district; but I arrived at no definite conclusion other than that just expressed.

14. *Rattus rattus rufescens*, Gray.

1837. *Mus rufescens*, J. E. Gray, *Ann. Mag. N. H.*, I, p. 577.
1912. *Epimys rufescens*, Wroughton, Rep. No. 1, *J. Bombay N. H. Soc.*, xxi, p. 405, and subsequent reports.

Type:—A skin and skull from Dharwar (B. M. 44.9.15.2), collected by Sir W. Elliot.

Gray's name *rufescens* may be conveniently employed for all those dark bellied Indian rats which seem to be intimately connected with one or other of the Indian wild races of *R. rattus*. Such rats are characterized by having a more or less rufous or ochreous dorsal coloration; rough haired bellies, which usually show a more or less evident rusty tinge or bloom; external proportions and skulls agreeing more or less closely with those of the wild races.

The series collected in the Central Provinces and in Kathiawar have already been described (pp. 77 and 83); they form the best examples of a close connection between the dark bellied and the wild forms of *rattus* in a given locality. In other districts, as in Kumaon or in the Koyna Valley, the dark bellied rats, although clearly of Indian origin, seem to have little or no connection with the wild stock living in their immediate vicinity. In still other places, as Gwalior and Cutch, where there is no wild race extant, the rats appear to be more modified, either as the result of longer domestication, or of contact with rats from other regions. It is noteworthy that specimens collected at Dharwar, the type locality of *rufescens*, by Mr. Hudson in 1907 and more recently for the Mammal Survey by Mr. Shortridge, can no longer be considered typical; like those from Gwalior, these specimens are obviously modified to a greater extent than is the type of *rufescens*.

The following are the external measurements of the dark bellied rats (other than those from the Central Provinces and Kathiawar, which have been dealt with above at pp. 77 and 83) mentioned in the tables of skull measurements:—

Coonoor, NILGIRI HILLS; collected by R. C. Wroughton (B. M. 98-3-5):—

·23 ♂, 13 Dec. 1897 156—185—32—21 = 100-119-20·5-13·5.

Dorsal colour much as in *R. r. wroughtoni*; belly with slight rusty tinge; fur soft; feet dusky.

SOUTHERN and EASTERN MYSORE; collected by G. C. Shortridge:—
Seringapatam (B. M. 13.4.11)—

·92 ♂, 17 Oct. 1912 178—208—31—21=100-117-17·4-11·8 $4\frac{3}{8}$ oz.
·96 ♀, 17 ,, ,, 168—213—32—23=100-127-19·1-13·7 $3\frac{7}{8}$,,

Bellies with more or less evident rusty tinge; feet dusky. 12 mammæ.

Bangalore.
·83 ♂, 3 Sept. 1912 178—220—34—23=100-124-19·1-12·9 $4\frac{5}{8}$ oz.
·88 ♀, 9 ,, ,, 169—219—34—22=100-130-20·1-13
12 mammæ.

Kolar Town.
·94 ♀, 20 Sept. 1912 164—230—33·5—21·5=100-140-20·4-13·1.

Like those from Seringapatam; dorsal colour in all rather variable.

NORTHERN MYSORE and KANARA; collected by G. C. Shortridge (B. M. 12.11.28.).

Sagar, Shimoga District.
·110 ♀, 11 June 1912 150—200—33—21·5 = 100-133-22-14·3.
Feet light, with dusky markings.

Gersappa, Kanara.
·105 ♂, 27 May 1912 198— 34—22 = 100-17·2-11·1 5⅝ oz.
A dark rat, with heavy tinge of rust on belly.
Dharwar; collected by G. C. Shortridge (B. M. 12.6.29.) :—
·93 ♂, 15 Nov. 1911 175—229—34—24 = 100-131-19·4-13·7.
·96 ♀, 15 „ „ 164—188—31—23 = 100-115-18·9-14.
Average of 13 adults :—149-185-30·1-21·1 = 100-124-20·2-14·3.

In some of the specimens from this district the fur is soft, in others harsh and spiny; usually rather short and sleek on belly, which has usually a rusty tinge; pectoral spots of white present in several; females with 12 mammæ.

KOYNA VALLEY; collected by S. H. Prater (B. M. 15.7.3.) :—
Ghatmatha.
·54 ♂, 15 Dec. 1914 155—214—32—21=100-138-20·7-13·6
Helwak.
·51 ♂, 9 Dec. 1914 172—228—31—21 =100-133-18-12·24¾ oz.
·52 ♀, 6 „ „ 175—214—32—18 =100-122-18·3-10·3
·53 ♀, 12 „ „ 175—227—30—24 =100-130-17·2-14·7

Dorsal colour very dark brown, more or less clouded with black; bellies with rusty tinge; feet dusky. Skulls differ from *R. r. satarœ* in many characters of proportion (see tables II (*b*) and II (*f*), part III); in having the temporal ridges and supraorbital beads very strongly, instead of very weakly developed; and the palate is relatively shorter than in any other Indian form—shorter than in European races.

EAST KHANDESH; collected by C. A. Crump (B.M. 11.12.21.) :—
Bhadgaon.
.21 ♂, 21 Mar. 1911 198—240—35—25=100-121-17.7-12.67¾ oz.
Rusty brown above and below; belly with strong wash of yellow. Looks as though all black pigment had bleached out of this specimen.
Ghodasgaon.
.22 ♀, 29 Apr. 1911 158—209—33—22 = 100-132-20.9-13.9 mammae 10.
Back dark brown; belly slaty with some yellow; feet dark.

Berars; collected by C. A. Crump (B. M. 12.3.8.) :—

Harisel.

.10 ♀, 12 June 1911 150—199—31—22=100-133-20.7-14.7 3½oz. mammæ 10.

Pili, Sipna Valley.

.9 ♂, 2 June 1911 157—210—33—23=100-134-21-14.7 4 oz.

Bellies rougher than in specimens from Nimar, and showing a strong rusty bloom.

Nimar; collected by C. A. Crump (B.M. 12.6.28.) :—

Ganoor.

.50 ♂, 22 Dec. 1911 145—200—32—23=100-138-22.1-15.9 3 oz.
.31 ♂, 25 ,, ,, 152—220—35—23=100-145-23 -15.1 4 ,,

Asirgahr.

.32 ♀, 21 Oct. 1911 154—212—31—24=100-138-20.1-15.6 4¼oz. mammæ 10.

Chandgahr.

.33 ♀, 5 Dec. 1911 159—195—31—22=100-123-19.5-13.9 4¾ oz. mammæ 10.

All with sleek bluish bellies; but traces of rusty tinge still more or less evident.

Gwalior, collected by Major Mayor (B. M. 15.7.2.) :—

Chorpura.

.15 ♂, 31 July 1914 180—205—33—24=100-114-18.3-13.3 6 oz.
.16 ♂, 5 Aug. ,, 174—205—31—21=100-118-17.8-12.1 6½ ,,
·17 ♀, 31 July ,, 163—190—30—21.5=100-116-18.4-13-2 4½ ,,
.18 ♀, 5 Aug. ,, 175—204—32—24 = 100-116-18.3-13.7 6¼ ,,

Dark brown above; bellies with close short hair, with a yellow tinge, in males, blue without rusty bloom, in females.

Palunpur, Gujerat; collected by C. A. Crump (B. M. 13.9.18.):—

Palunpur.

.66 ♂, 3 Apr. 1913 178—225—35—25=100-126-19.7-14 6 oz.
.67 ♀, 22 Mar. ,, 165—227—34—23=100-137-20.6-13.9 5½ ,,

Danta.

.69 ♂, 18 June 1913 160—207—30—23=100-129-18.7-14.4 5½ oz.

Average of 24 from this district :—

156—207—32.2-22.6=100-133-20.6-14.5.

Bellies usually with distinct rusty tinge; in 10 females examined, 8 show 10 mammæ, 1 shows 11, and 1 shows 12.

Cutch; collected by C. A. Crump (B. M. 12.10.4.) :—

Bhuj.

.66 ♂, 27 July 1911 155-224-32-23=100-144-20.6-14.8 5¼ oz.
.67 ♂, 27 ,, ,, 164-223-33-23=100-136-20.1-14 5¾ ,,
.68 ♂, 31 ,, ,, 160-225-33-22=100-141-20.6-13.7 4½ ,,
.69 ♀, 27 ,, ,, 165-220-31-24=100-133-18.8-14.5 4¾ ,,
.70 ♀, 31 ,, ,, 164-208-32-22=100-127-19.5-13.4 4¾ ,,
.71 ♀, 21 Aug. ,, 163-217-33-23=100-133-20.2-14.1 5 ,,

Ventral hairs in all short and adpressed; yellow tinge present in some, almost absent in others. Mammæ 10, constant.

RAJPUTANA; collected by C. A. Crump (B. M. 13.9.18.):—
Mt. Abu.
.68 ♂, 18 May 1913 170— —32-24=100- -18.8-14.1 6 oz.
Belly light grey, with very feeble trace of a yellow pectoral stripe.
KUMAON; collected by C. A. Crump (B. M. 14.7.10.);—
Philibhit, altitude 800 feet.
.107 ♂, 2 Mar. 1914 151-193-31—21=100-128-20.5-13.9.
.108 ♀, 3 ,, ,, 163-214-30.5-22=100-131-18.7-13.5 4¾ oz.
.109 ♀, 6 ,, ,, 171-233-32—23=100-137-18.7-13.5 7½ ,,
.110 ♀, 6 ,, ,, 170-222-33—24=100-131-19.4-14.1 5¾ ,,

No white bellied rats were obtained at this locality (see Wroughton, *J. Bombay N. H. Soc.*, xxiii, p. 295), I have seen 8 specimens of "*rufescens*" from Philibhit; the fur is rather long and soft in the younger, thinner, harsher, and with a few spines in the older individuals. Dorsal colour varies between reddish and greyish brown. Bellies with rather long hair, slaty bases, a rusty tinge and merging gradually in the flank colour. Feet light brown above, with a dusky wash—best marked in the redder specimens.

Ramnagar, altitude 1,100 feet.
.98 ♂, 13 Dec. 1913 178- -34-23=100- 19.1-12.9 6 oz.
.99 ♀, 2 ,, ,, 142-190-31-22=100-134-21.8-15.5
.100 ♀, 3 ,, ,, 150-191-33-22=100-127-22 -14.7
.101 ♀, 5 ,, ,, 170- -32-22=180- -18.8-13 5 ,,

These strike me as being slightly paler above than the specimens from Philibhit; they have more grey and less red upon their backs; the bellies have a yellowish-grey tinge; feet grey with more or less brown.

Dela, Ramnagar, altitude 1,500 feet.
.106 ♀, 10 June 1914 164-211-32-23=100-129-19.5-14 6 oz.
Agrees with specimens from Ramnagar. Mammæ 12.

Jerna, Ramnagar; altitude 1,500 feet.
.102 ♂, 17 Jan. 1914 161-192-32-21=100-119-19.9-13
.103 ♂, 19 ,, ,, 142-201-33-21=100-142-23.3-14·8
.104 ♂, 20 ,, ,, 167-230-36-23=100-138-21.6-13.8 6 oz.
·105 ♀, 19 ,, ,, 163-222-35-22=100-136-21.5-13.5

5 adults from this place average much darker in general colour than those from Ramnagar or Philibhit. Backs heavily clouded with black, flanks brown; bellies with rusty tinge; fur rather harsh; feet dusky; and tails very dark also. One young specimen, however, is very brightly coloured, its back being markedly rufous.

In the majority of the female *rufescens* from Kumaon, the mammary formula is 2-3=10; one or two, however, have 12 mammæ.

Judging from their external appearance and from their skulls, these rats are nearly related to *R. r. narbadæ* and *girensis*, and have little or nothing to do with *R. r. gangutrianus*

15. *Rattus rattus nemoralis*, Blyth.

1851. *Mus nemoralis*, Blyth, *J.A.S.B.*, vol. xx, p. 168.

1915. *Epimys nemoralis*, Wroughton, *J. Bombay N. H. Soc.*, vol. xxiv, p. 49.

Type:—The co-types of this sub-species are in the Indian Museum, Calcutta; a female labelled by Blyth and presented by Dr. Kelaart to the British Museum (52.5.9.28) is, as pointed out by Wroughton, a metatype.

Distribution:—"Distributed sparsely as a tree-rat all over Ceylon, up to 1,500 feet altitude," (Wroughton).

Material examined:—The metatype; and 37 collected for the Mammal Survey by Major Mayor.

In outward form and coloration this rat is hardly to be distinguished from *rufescens*. Judging from the skull measurements given in tables II (*d*) and II (*g*), part III, *nemoralis* differs rather conspicuously from *r. kandianus* in its longer pterygoid region, shorter nasals, and less closely approximated temporal ridges. *R. r.* "*rufescens*" is far too indefinite a "subspecies" to compare in these respects; as an insular and more easily definable race, *nemoralis* may conveniently be retained as distinct.

The dimensions of the specimens mentioned in the table of skull measurements are;—

Colombo (B.M. 15.3.1.):—
.173 ♂, 25 Apr. 1913 209-235-34 -23 = 100-112-16.2-11
S.1 ♂, 29 Mar. ,, 160-197-31.5-22 = 100-123-19.7-13.7
.174 ♀, 25 Apr. ,, 203-215-32 -21 = 100-106-15.7-10.3
Hambantota.
.175 ♂, 5 June 1913 175-212-31.5-22 = 100-121-18 -12.6
.176 ♀, 13 ,, ,, 164-215-31.5-22.5 = 100-131-19.2-13.7
Kandy.
.182 ♂, 16 Feb. 1914 159-204-30 -20.5 = 100-128-18.9-12.9
Average of 32 in adult pelage:—
160-191-30.8-21.1 = 100-119-19.25-13.2

The mammæ are usually 2-3 = 10, but 12 were counted in one specimen, and 11 in another.

16. *Rattus rattus alexandrinus*, Geoffroy.

1916. *Rattus rufescens* and *rufescens* var. with white underparts, Wroughton, Report No. 24, *J. Bombay N. H. Soc.*, xxiv, p. 756.

The rats collected in Sind for the Mammal Survey by Mr. S. H. Prater, together with some specimens from the same region presented to the British Museum by the Bombay Government in 1907 and 1908, are very different from those from other parts of India; and they may for the present be referred to *R. r. alexandrinus.*

On the backs the fur is short and harsh, although not spiny; the bellies are smooth, being clothed with short and adpressed fur. The dorsal colour is markedly paler than in any of the other Indian specimens; it is a pale yellow brown or tawny, more or less heavily lined with black, especially along the spine. The flanks lighten gradually and pass, in the majority of the specimens, insensibly into the belly; the latter shows a conspicuous yellowish suffusion and the ventral hairs have deep slaty bases. In a few of the specimens, the ventral hairs (and consequently the bellies) are pure white throughout; in these, the line of demarcation along the flanks is distinct. In the normal dark bellied type, the feet are rusty coloured above; in the rarer white bellied individuals, the feet are whitish. The tails are unicolored and more or less dusky. The mammary formula is indifferently 2-3=10 or 3-2=12. The following are the dimensions of the more important;—

Dark bellied—

15.11.1.110 ♂,	27 Feb. 1915	160—193—32—24	Jacobabad.
.111 ♂,	28 ,, ,,	150—196—34—23	,,
8.1.22.9 ♀,	25 Nov. 1907	161—193—31—22	,,
10 ♀,	25 ,, ,,	181—227—35.5-32	,,
15.11.1.112 ♀,	4 March ,,	160—205—31—21	Kashmor.
113 ♀,	8 ,, ,,	157—197—32—22	,,
8.1.22.11 ♂,	16 Dec. ,,	163—212—33.5-23	Sakkur.

White bellied—

15.11.1.114 ♀,	21 Feb. 1915	154—195—35—21	Jacobabad.
M.S.I. 608 ♀,	13 Mar. ,,	166—203—32—23	,,
15.11.1.115 ♂,	19 Apr. ,,	154—201—31—20	Gambat.

The skulls are a little smaller than in European *alexandrinus*, the nasals appear to be slightly shorter and broader, while the incisive foramina are a little longer relatively.

Remarks.—The exact status of these rats cannot be settled without further material.

II. *Rattus macmillani*, sp. nov.

1916. *Epimys rufescens* var. with white underparts, Wroughton, Report No. 20 (Chindwin River), *J. Bombay Nat. Hist. Soc.*, vol. xxiv, p. 307 (in part).

Type.—A male (B. M. No. 15.5.5.226; Original No. 5972) collected by Mr. G. C. Shortridge and the late Captain S. A. Macmillan, on 8th August, 1914, on the west bank of the Upper Chindwin River opposite Hkamti, Upper Burma.

Material examined.—Seven (4 ♂, 3 ♀), all from the type locality (1 ♀ being, however, from the east bank of the river)

Description.—This is a dark coloured, moderately long tailed member of the *Rattus* group.

The fur is short, thin and rather harsh—being intermixed, in adults, with numerous soft, greyish-white bristles. The dorsal colour is black, finely grizzled with greyish white and tawny; the blackness is chiefly due to the presence of numerous long black hairs, which are especially numerous along the mid-dorsal line and particularly conspicuous over the rump. The bellies are pure white, the ventral hairs being white to their bases. The line of demarcation along the flanks is sharply defined. The feet are light brown, darkened above by a more or less evident dusky marking. The tail averages about 130 % of the head and body length, and is dusky throughout—above and below. The female has 12 mammæ. The following are the dimensions of the more important specimens;—

5847, ♂, 27 July 1914 156-200-33.5- 20=100-128-21.5-12.8
.226 5972, ♂, 8 Aug. ,, 158-205-34- 22=100-130-21.5-13.9
5975, ♂, 8 ,, ,, 150-211-35- 21·5=100-141-23.3-14.3
.227 5973, ♀, 8 ,, ,, 169-222-32.25-22=100-131-19.1-13
5974, ♀, 8 ,, ,, 154-187-32.5-21.75=100-121-21.1-14.1
Average of 7;— 150-195-32.9-21.5=100-130-22-14.3

The skull is small, the condylo-basal length averaging 37.2 in four specially examined. It differs little in form from that of the Indian races of *R. rattus*. Among Burmese races it is distinguished by its small bullæ (see dimensions in tables II (*e*) and II (*g*), part III) and relatively great cranial width; the latter dimension exceeds the occipital breadth by an amount equal to 3 % of the condylo-basal length. The interpterygoid fossa is wide and the palate develops no median posterior projection. The temporal ridges run at a relatively high level, and in old age tend to obliterate the supratemporal articulation of each parietal with the supraoccipital.

Remarks:—This form is so sharply differentiated from all the others described in this paper that it seems to demand recognition as a full species. I have great pleasure in naming it in honour of the late Captain S. A. Macmillan who, in conjunction with Mr. Shortridge, did so much good work for the Mammal Survey. In general appearance *R. macmillani* is strikingly similar to *R. mentosus*, Thos., described (*J. Bombay Nat. Hist. Soc.*, xxiv, p 643) from the same locality; the resemblance of course is quite superficial, for *mentosus* belongs to a widely different group and has a bi-colored tail, 8 mammæ only, and a very peculiar skull.

Certain specimens obtained by the Survey at Tamanthe and one (No. 5310) from Kin, Lower Chindwin, make a more or less close approach in external and cranial characters to *R. macmillani*; and for the moment I propose to leave them with this form.

III. *Rattus kelaarti*, Wroughton.

1915. *Epimys kelaarti*, Wroughton, *J. Bombay N. H. Soc.*, vol. xxiv, p. 48.

Type:—A male (B. M. 15.7.1.7; Original No. 952) collected at Pattipola, Ceylon, by Major Mayor on 21st February, 1914; presented to the British Museum by the Bombay Natural History Society.

Distribution:—Highlands of Ceylon, 5,000 to 6,000 feet.

Material examined:—In addition to two specimens presented to the British Museum long ago by Dr. Kelaart, I have examined 54 (42 adults) obtained by the Mammal Survey.

Description:—In general appearance this rat somewhat closely resembles *R. nitidus*, but its skull agrees exactly with that of such normal subspecies of *R. rattus*, as *r. kandianus* or *r. narbadæ*.

The fur is long, dense, and soft. The general dorsal colour is a dark olive-brown, mixed with a large proportion of black hairs. The underparts are of an impure white, the ventral hairs having deep slaty bases, which usually show through and tend to obliterate the line of demarcation. The tail is relatively short, averaging about 117 % of the head and body length in specimens with the latter dimension from 150 mm. and upwards. The females have 10 mammæ. The following are the dimensions of the specimens dealt with in the tables of skull measurements:—

15.7.1.7	♂, 21 Feb. 1914	156-176-32- 21	(type)	Pattipola.
15.3.1.218	♂, 5 Mar. „	166-175-31.5-22		„
S. 1001	♀, 3 „ „	148-198-30- 20·5		„
15.3.1.223	♀, 20 „ „	146-172-31- 20		Ambawela.
.224	♀, 1 Apr. „	162-174-34- 21		„
Average of 10 adults :—		157-184-32.5-20·6		
„ % of head and body—		100-117-20.7- 13.1		

The specimens examined give the following growth table:—

Head and body mm.	No. of specimens.	Average % of head and body length formed by:— H. & B. Tail. Hind-foot. Ear.
90-119	12	100—127—26.1—16.8
120-129	10	100—125—23.8—15.2
130-139	11	100—124—23— 14.5
140-149	10	100—126—21.1—14.2
150-159	7	100—120—20.8—13.4
165-167	4	100—110—19— 12.4

The skull differs from that of *R. r. kandianus* only by its smaller size.

Remarks:—The peculiar appearance of this species first attracted the attention of Kelaart, who thought it allied to, if not identical with *nitidus*. The skull, however, proves that *R. kelaarti* is closely related to *R. rattus*; and its external similarity to *nitidus* must, perhaps, be attributed to its highland environment.

IV. *Rattus nitidus*, Hodgson.

1845. *Mus nitidus*, Hodgson, *Ann. Mag. N. H.* (1) xv, p. 267.
1881. *Mus alexandrinus* var. *nitidus*, Thomas, *P. Z. S.*, 1881, p. 533.
1891. *Mus rattus* var. *nitidus*, Blanford, *Mammalia*, p. 407.
1914. *Epimys nitidus*, Wroughton, Report No. 15, *J. Bombay N. H. Soc.*, xxxiii, p. 296, Report No. 23, *ibid*, xxiv, p. 489.
1916. *Rattus nitidus*, Wroughton, Report No. 26, *J. Bombay N. H. Soc.*, xxiv, p. 782.

Type:—A skin and skull from Nepal, B. M. No. 79.11.21,415; received from the India Museum, *ex* Hodgson's collection.

Material examined:—(1) The type and other old specimens in the British Museum; (2) the long series obtained in Kumaon and Sikkim by the collectors of the Mammal Survey.

Description:—In this species the tail is much shorter than in Indian races of *R. rattus*—its average length, in the typical subspecies, being equal to no more than 107 % of the head and body measurement. The hind-foot is larger, measurements above 35 mm. being common; and the head also, judging from the skull measurements discussed below, is relatively larger than in Indian *R. rattus*.

The fur is remarkably soft and smooth, with an abundance of soft under fur, the middle hairs and long black hairs being extremely fine, and the bristles or soft spines, found commonly in *R. rattus*, being wholly absent.

The general dorsal colour, as seen from a distance, is dark and approaches a deep chocolate or "seal brown." The ground colour is a dark brown or grey, more or less finely grizzled with yellowish brown shades, which range from tawny to "mummy brown," and darkened, particularly along the spine and over the rump, by the long black hairs. The latter are often sufficiently numerous to form a broad black streak, extending from the middle of the back to the root of the tail. The bellies range from silver to dusky hoary. The ventral hairs have white tips and darker bases, the basal tint varying from a pale grey to slate colour. In specimens with light bases to the ventral hairs, the bellies are sharply contrasted with the flanks and the line of demarcation, although not a hard one, is regular. In the darkest specimens, the flank and ventral colours tend to merge insensibly in each other. The feet are almost constantly of a dirty white colour above. The tail is unicoloured and dusky, although the precise hue is subject to considerable individual variation.

Among the great number before me only two specimens deviate considerably from the coloration above described. One from Pashok, Darjiling (B. M. 17.7.9.1, ♂, is exceptionally dark above and below; in this, the belly is almost concolor with the flanks, only a few of the more centrally placed ventral hairs having conspicuous silvery tips. The other from Ghoom, Darjiling (B. M. 15.9.1.149, ♀) has a rather distinct black stripe along the spine, chocolate flanks—lacking the yellowish brown tints normally present, and a silvery white belly—the ventral hairs being white to their bases. In a very few specimens the feet are darkened above by a dusky marking.

The females have a mammary formula of 3-3=12, in one specimen 4 pectoral mammæ were present on one side, the normal 3 on the other.

The dimensions of the specimens whose skulls were specially examined are:—

Kumaon (B. M. serial No. 14.7.10.):—
.141 3783 ♀, 24 Sept. 1913 170-175-34-21. 6 oz. Lwarkhet, 6,000′.
.144 3684 ♀, 7 ,, ,, 176-179-34-21. 6 oz. Khati, 7,600′.
.146 4413 ♂, 10 Feb. 1914 161-178-37.5-20 6 ,, Lohaghat, 5,600′.
.147 4433 ♂, 12 ,, ,, 171-184-36-21 ,,
Average of 12:— 168-177-35.7-20.8
,, % of head and body:—100-105-21.2-12.4

Sikkim (B. M. serial No. 15.9.1.):—
.149 6296 ♀, 15 Feb. 1915 175-192-34-23 5 oz. Ghoom, 7,400′
.157 5864 ♂, 30 Nov. 1914 171-182-38-22 Gangtok, 6,000′
.161 6288 ♀, 10 Feb. 1915 167-162-34-21 4½oz. Ghoom, 7,400′
.163 6340 ♀, 15 ,, ,, 163-167-35-20 5 ,, ,,
40 ♂, 6 May 1915 185-195-37-23 Gopaldahra.
68 ♀, 16 ,, ,, 184-185-34-22 ,, 4,720′
305 ♀, 5 July ,, 155-148-33-23 ,,
Average of 70 adults:— 160-171-33.9-22.2
,, % of head and body:—100-107-21.2-13.9

The following growth table resulted from an examination of 65 individuals from Sikkim :—

Head and body in mm.	No. of specimens.	Average °/₀ of H. & B. formed by :— H. & B. Tail. Hind-foot. Ear.
112-116	3	100—117—26.5—17.5
126-127	2	100— —24.8—16.2
130-139	4	100—111—23.7—15
140-149	9	100—108—22.7—15.4
150-159	18	100—109—21.7—14.7
160-169	14	100—102—21 —13.4
170-179	12	100—103—20 —13.1
180-185	3	100—101—19.2—12.3

The skull is large, the average condylo-basal length being about 41 mm. The temporal ridges traverse the brain-case at a rather low level, but form strong beads on the posterior portions of the frontals. The nasals are considerably longer than in *R. rattus*; the diasteme and the pterygoid region are also longer, while the bullæ are smaller. These differences will be appreciated best from the measurements in the tables II (*h*), part III. In the cheek-teeth, *m. 1* has the antero-external tubercle (cusp 1) greatly reduced—almost indistinguishable from the median tubercle (cusp. *x*.).[1]

Remarks:—The claim of *R. nitidus* to rank as a species distinct from *R. rattus* is placed beyond question by its characteristic external appearance, peculiar skull, and its restricted distribution in India, where it is confined to the Himalayas. The large number of specimens now at hand from many localities in Kumaon and Sikkim agree closely with each other, as well as with Hodgson's type from Nepal. There is, of course, in this long series a good deal of minor individual variation in colour; but viewed broadly the coloration is remarkably uniform, while the essential characters relating to the quality of the pelage, mammæ, external and cranial proportions appear to be very constant. The statement in Thomas's paper of 1881, repeated in Blanford, to the effect that the fur of this form is frequently spiny, is an error due to the confusion of *nitidus* with *rattus* and other species. This confusion and such errors were unavoidable so long as one had to work with nothing

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(1) For explanation of this cusp. nomenclature, see Barrett-Hamilton and Hinton, *British Mammals*, Pt. xvi, p. 504, Pl. 28 (1914).

better than the wretched and scanty material bequeathed to us by the pioneers of Indian mammalogy.

Sclater (*Cat. Mamm. Ind. Mus. Calcutta,* 1891, Pt. II, p. 67) lists specimens of "*nitidus*" from Assam and Manipur; but without seeing the material it is, of course, impossible to say whether it is correctly determined or not. Mr. F. M. D. Mackenzie, collecting in the Chin Hills for the Mammal Survey, has recently obtained there some specimens, which are undoubtedly referable to *R. nitidus.* They differ from the typical Himalayan form described above and may therefore be referred to a distinct subspecies, which I propose to call :—

Rattus nitidus obsoletus, subsp. n.

1916. *Rattus rufescens*, Wroughton, Report No. 25, *J. Bombay N. H. Soc.*, xxiv, 771.

Type :—A female (B. M. 16.3.26.52 ; Original No. 309) collected on the Chin Hills, at a point 50 miles west of Kindat, altitude 5,000′, on 23 April, 1915, for the Mammal Survey, by Mr. F. M. D. Mackenzie ; presented to the British Museum by the Bombay Natural History Society.

Material examined :—Chin Hills (5,000′) : (1) 50 miles west of Kindat, 4 (1 ♂, 3 ♀); (2) 65 miles west of Kindat, 1 adult (♀, No. 428) ; and 9 young specimens in dusky juvenal pelage, from same district.

Description :—General character much as in typical *nitidus*, but with still shorter tail, and considerably shorter and thinner fur. The dorsal colour differs little from that of true *nitidus*, but the belly is clothed with much shorter fur and shows a rusty suffusion, recalling the underparts of "*rufescens*". The feet are of the normal dirty white or yellow colour, and the tail is dusky, above and below, throughout. The females show a constant mammary formula of 3-3=12. The following are the dimensions of the adults :—

359 ♂,	27 April 1915	187-175-34.5-21.5	=100- 94-18.5-11.5
·52 309 ♀,	23 ,, ,,	178-165-35-23	=100- 93-19.6-12.9
310 ♀,	23 ,, ,,	161-165-34-22	=100-103-21.1-13-7
389 ♀,	28 ,, ,,	143-140-34-20	=100- 98-23.8-14
428 ♀,	8 May ,,	174-186-37-23.5	=100-107-21.3-13.5
Average of 5:--		168-166-34.9-22	=100- 99-20.7-13.1

The skull agrees closely in form and size with that of typical *nitidus.* From the relative dimensions given in the table II (*i*), part III, it will be seen that the nasals are a little shorter and broader, the post-molar length a little greater relatively than in the

Himalayan animal. In these respects, as with most of the other minute differences brought out by the measurements, skulls of *n. nitidus* from Sikkim make a nearer approach to the present form than do those from Kumaon. The bullæ of *n. obsoletus* seem to be a trifle smaller and rounder than those of true *nitidus*.

As regards the cheek-teeth, cusp 1 of m^1 is even more reduced than in *n. nitidus* ; and the postero-external tubercle (cusp 5) in both m^2 & m^1 is also unusually small and scarcely separated from the median tubercle (cusp. *z*).

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XIX.

A SYNOPSIS OF THE GROUPS OF TRUE MICE FOUND WITHIN THE INDIAN EMPIRE.

BY OLDFIELD THOMAS.

At the request of Mr. Wroughton, with a view to the preparation of his "Summary," I have made an attempt to find out the natural relationships to each other of the many forms of "*Mus*" that have been described from the Indian Empire, and now venture to submit, with some diffidence, the following synopsis of these most difficult animals.

As will be seen, it is very far from being a complete working out of the species, but at least it sorts them into their natural groups, and so makes a step towards their further elucidation.

The characters given in the synopsis are of necessity not such as can be used by sportsmen in the field, being mainly based on the skulls, of which some technical knowledge is needed—but this is a fault which is inherent in all such work.

Synopsis.

A. Muzzle short—distance from gnathion to front bottom corner of zygomatic plate not, or barely, exceeding breadth across molars. (True House Mice.)
- a^1. Tail about as long as head and body.
  - a^2. Colour some tone of grey or brown ... ...(1) *musculus* group.*
  - b^2. Colour more or less sandy, with white belly ... ...(2) *bactrianus* group.†
- b^1. Tail much shorter than head and body—colour sandy ... ...(3) *pachycercus*.‡

B. Muzzle normal—the distance above defined decidedly greater than breadth across the molars. (Field-Mice.)

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* Includes, of Indian species, *dubius*, *homōurus* and *urbanus*, (1845), *æquicaudalis* (1851), *manei* (1852), *tytleri* (1859), *kakhyensis* and *viculorum* (1878).

† Includes *gerbillinus* and *theobaldi* (1853). Although provisionally put as a "group" there is little doubt that *bactrianus* will prove to grade into *musculus* through such forms as *Mus musculus gentilis* of N. Africa, Arabia, &c.

‡ Not strictly Indian having been described from Yarkand. Probably it is synonymous with *M. wagneri*.

- *a^1*. Supraorbital edges quite without any thickening; incisors generally bent backwards (opisthodont).
  - *a^2*. Size larger; brain-case rounded, its breadth more than 10mm; palatal foramina penetrating less between morals.
    - *a^3*. Palatal foramina very short, not reaching at all between molars (Sikkim) ... ...(4) *pahari.*
    - *b^3*. Palatal foramina longer, reaching just between the front part of m^1 ...
      - *a^4*. Colour very dark coppery; underside scarcely lighter, washed with ochraceous. (South India) ...(5) *famulus.*
      - *b^8*. Colour normal, brown; underside lighter, greyish white. (Burma)..(6) *cookii.*
  - *b^2*. Size smaller, often very small, braincase narrow (less than 10mm broad), not specially rounded. Palatal foramina penetrating far between molars ... ...(7) *booduga* group¶.
- *b^1*. Supraorbital edges thickened in old age; incisors about upright (orthodont). (S. Burma) ...(8) *nitidulus.*

But further, since the above synopsis was prepared without any thought of a generic split among the mice, and its primary division comes exactly between the House-mice and the Field-mice, the question again arises as to the possibility of re-establishing the genus *Leggada*, which was used for a number of years as valid, and then more recently (Miller, Mamm. W., Europe, p. 863, 1912) united with *Mus*.

¶ Includes *booduga* (1837), *lepidus* (1839), *cervicolor* and *strophiatus* (1845) *terricolor* (1851), *darjilingensis* (1851), *fulvidiventris* and *albidiventris* (1852) *cunicularis* (1855), *beavani* (1866), and *dunni* (1912). The position of *cervicolor* has long been in doubt, but the study both of the type and of authentic specimens sent by Hodgson, in spirit, shows that it is a large and rather long-eared species of the present group. And *M. darjilingensis* is also the same species and not a member of the *musculus-dubius* group, as has been supposed.

I have therefore again examined all the pertinent African species to see how far the natural grouping corresponds with that of the Indian ones, and if so whether the groups can be defined satisfactorily.

The geography of the case has first to be considered. For in the East all the true native Indian forms come under B, those falling under A being either the artificially transported and parasitic *musculus*, or else Palæarctic in locality. Should we therefore find that in the west those corresponding to A were again Palæarctic and those to B Ethiopian, the case for separation would be greatly strengthened.

And this is exactly what we do find. The short-muzzled, *musculus-like* forms range over the whole of Europe, are found in North Africa and in Egypt, along the Nile as far south as Khartoum, but beyond that are not found in any part of Africa, the Ethiopian forms being all of the B type.

We thus find that the A group is by nature Palæarctic only, a more or less artificial extension of it southwards to Khartoum in Africa and over all India being effected by the parasitic habits of *Mus musculus* itself, just in the regions of the ancient civilizations of Egypt and India. And on the other hand the B group is Ethiopian and Oriental, not penetrating at all into the Palæarctic.

This seems to indicate that the groups A and B, or to call them now by their technical names, *Mus* and *Leggada*, are really distinct natural groups which it would be both convenient and true to nature to recognise as separate.

The essential characteristic of *Mus*, as compared with *Leggada* is the shortening of the muzzle, a shortening which is emphasised by a somewhat more forward position of the anterior zygoma-root. Looking at the skull from below the whole zygomatic plate is pushed forward, so that its anterior edge comes opposite a point in front of the middle of the palatal foramina while in *Leggada* it is at or even behind the middle. The length of the nasals in *Mus* is generally about equal to the distance from the external edge of one tooth-row to the outer side of the zygoma of the opposite side, or (perhaps a better comparison) to the distance between the lips of the auditory meatus of the two sides. In *Leggada* the nasal length generally decidedly surpasses these two distances. Not only is the muzzle of *Mus* shorter, but it is a little broader, so that the distance between the two anteorbital fossæ goes less than three times in the nasal length, in *Leggada* more than three times.

Every individual skull will not always answer to each of these tests, but on the whole there is rarely a case where one is doubtful as to which of the two groups a species should be placed in.

The most doubtful are the short-tailed mice known as *algirus* and *spicilegus*, which more approach *Leggada* and have less of the *musculus* specialization. But on the whole they are best referred to *Mus*, in whose geographical area they occur.

To *Mus* therefore I would refer the following, with their subspecies, *viz.* :—

musculus, L.
fœroensis, Clarke.
algirus, Loche.
bactrianus, Bly.
gentilis, Brants.
spicilegus, Pet.
wagneri, Eversm.
muralis, B-Ham.

Leggada would then include :—

pahari, Thos.
booduga, Gray (genotype).
famulus, Bonh.
nitidulus, Bly.
cookii, Ryl.

and in addition the whole of the African species referred formerly to *Leggada* (*minutoides*, *pasha*, &c., &c.) and in recent years by Miller, Heller and Dollman, to *Mus*.

The following new forms may be conveniently described here :—

Leggada nitidula popæa, subsp. n.

Size rather greater than in true Pegu *nitidula* ; colour rather paler, the posterior back without the distinctly darker median area usually present in that animal. General colour above rather darker than "drab." Below pale gray, the hairs slaty basally, greyish white terminally; line of demarcation on sides not very sharply defined, often faintly edged with buffy chin hairs white to base. Tail averaging longer than in true *nitidula*, its length measured as 75, 75·5, 78·5, 79, 80mm, in six specimens as compared with a range of 64 to 73mm in eight specimens of *nitidula* ; blackish above, white below, the contrast more marked than in *nitidula*. Mammæ 3—2=10 as usual.

Skull essentially similar to that of *nitidula*, but the tendency to a postorbital thickening or projection perceptible in *nitidula* is more strongly marked, the projection amounting, in old specimens, to heavy thickened ridges, which therefore contradict the formal rule that there are no such ridges in the present group. They are, however, quite short and do not extent back on to the parietals. Palatal foramina extending well between the first luminæ of m. Incisors as in *nitidula* more thrown forward, or (rather) less turned backwards, than usual, being about "orthodont" with indices 77° to 86°, most of the species having this index below 75° (opisthodont).*

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* Cf. Ann. Mag. N. H. (9) I, p. 35 (footnote) 1918.

Dimensions of the type, measured in the flesh :—Head and body 99mm; tail 78·5; hindfoot 17; ear 13. Skull, greatest length 24·2; condylo-incisive length 23·5; zygomatic breadth 12; nasuls 9; interorbital breadth 3·7; palatilar length 12·2; palatal foramina 5·5; upper molar series 3·9.

Hab. :—Mt. Popa, Dry Zone of Burma.

Type :—Old male. B. M. No. 14, 7, 19, 200. Original number 3917. Collected 29th September 1913 by G. C. Shortridge. Presented by the Bombay Natural History Society. Seven specimens.

Mus gentilulus, sp. n.

A small species of restricted *Mus*, about the size of *M. spicilegus*, but with the comparatively long tail of *Mus musculus* and *gentilis*.

Size small, form slender. General colour as in *M. gentilis*, the upper surface sandy fawn, the posterior back warmer, undersurface white, the hairs white to the roots in the type, but slaty at base in another specimen, and in yet another, they are slaty basally and washed terminally with dull buffy, as in the house haunting *Mus musculus*. Ears, of moderate size. Hands and feet white. Tail, of abont the length of the head and body, varying from a little shorter to a little longer.

Skull, of about the size and shape of *M. spicilegus* or rather smaller; markedly smaller than that of *gentilis*.

Dimensions of the type, measured in the flesh :—Head and body, 65 mm; tail, 66; hindfoot, 15·5; ear, 12.

Skull :—Greatest length, 20·3; condylo-incisive length, 19; zygomatic breadth, 10·6; nasals, 8·6; interorbital breadth, 4; palatal foramina, 5; upper molar series, 3·3.

Hab.—Aden. Type from Lahej, other specimens from Sheikh Othman.

Type.—Adult male. B. M. No. 99, 11, 6, 71. Original number 37. Collected 23rd August 1899 by W. Dodson. Five specimens.

This little mouse is the *Mus bactrianus* of the first and the No. 23 of the second of my papers on Aden Mammals (P. Z. S., 1895 p. 554 and 1900, p. 103). Its small size suggests a *Leggada*, but it is clearly a true *Mus*, and seems most related to *M. gentilis*, from which it differs by its markedly smaller size. On the other hand, judging by the length of the tooth-row, it is larger than *M. abbotti*, Waterh., of Trebizond, as yet only known to us by the immature type specimen. From the members of the *spicilegus* group it is distinguished by its longer tail.

A NEW SPECIES OF *NESOKIA* FROM MESOPOTAMIA

BY

OLDFIELD THOMAS.

The National Museum owes to Capt. P. A. Buxton, R.A.M.C., a number of small mammals obtained by him while campaigning in Mesopotamia. Among these there are examples of a *Nesokia* which on comparison with the Museum specimens, all recently determined by Mr. Wroughton (J. B. N. H. S. XVIII. p. 736, 1908), appears to represent a new species of the genus. It may be called—

NESOKIA BUXTONI, *sp. nov.*

Size and general characteristics very much as in *N. indica.* Fur not very coarse but more or less mixed with flattened semi-spinous hairs, those across the shoulders of the type, stiffer than in any other member of the genus. General colour above clear sandy fawn (nearest to "cinnamon buff" of Ridgway), lined with the black ends of the longer hairs. Sides clearer and more yellowish. Under surface practically white, the chin, chest, and inner side of limbs white, the belly pale buffy white, with scarcely any greyish at the bases of the hairs, at least in the adult, young specimens having more. Head browner than back. Ears short, almost naked, their few fine hairs white; a small whitish spot behind their basis on the nape. Hands and feet brown with whitish digits. Tail practically naked, its scattered short hairs brown.

Skull not certainly distinguishable from that of other allied species.

Dimension of the type, measured in the flesh :—

Head and body, 170 mm ; tail, 130 ; hindfoot, 35 ; ear, 19.

Skull :—condylo-basal length, 43 ; condylo-incisive length, 43 ; zygomatic breadth, 25·8 ; nasals, 13 × 5 ; interorbital breadth, 6·5 ; palatine foramina, 6 ; antero-posterior diameter of bullæ, 8·1 ; upper molar series (alveoli) 8·1, (crowns) 7·2.

Hab :—Mesopotamia. Type from Amara ; other specimens from Kurna and Basra.

Type.—Adult male. B. M. No. 18.8.5.5. Original number 209. Collected 24th April, 1918, and presented by Capt. P. A. Buxton.

Judging by the skulls, the members of the genus *Nesokia* prove to be much more closely allied to each other than I had hitherto supposed, it being almost impossible to distinguish with certainty the series of species (or perhaps rather sub-species) which are of the size of *N. indica*, the three larger forms *brachyura*, *scullyi*, and *bacheri* alone standing out from the rest. But the quality of the fur, and the general colour are fairly constant locally, and in these respects *N. buxtoni* is readily distinguishable by its sandy colouration above and its whitish belly, the only other species which has the upper surface buffy *N. huttoni*, having a buffy greyish belly, wholly different from that of the Mesopotamian Nesoki.

This animal is stated by Capt. Buxton to be very common at Amara, where its burrows are much in evidence. But it was found exceedingly difficult to trap, and now that after much trouble he has succeeded in getting specimens as a memento of the historic Mesopotamian campaign. I am glad to have the opportunity of naming the species in his honour.

SUPPLEMENTARY NOTES ON SOME INDIAN BIRDS

BY

B. B. Osmaston.

Students of birds in India must occasionally have come across statements in the volumes of the Fauna of British India, relating to birds, which do not fit in with their experience.

This is only natural considering the fact that these volumes were published from 20 to 30 years ago and that our knowledge of Indian Birds and their habits is increasing every year.

The following notes based on my own experience extending over nearly 30 years, spent mostly in the forests of the United Provinces, deal with some such cases which have from time to time attracted my attention and they are recorded in the hope that they may be of some general interest.

80. The Rufous-chinned Laughing Thrush—*Ianthocincla rufigularis.*

The F. B. I. says regarding the distribution of this bird: "It is found chiefly from 5,000 to 8,000 feet of elevation."

This does not agree with my observations. I have found it fairly common in the lower valleys of the Himalayas from 2,000 to 4,000 feet elevation; frequenting dense miscellaneous jungle, and have never seen it above 5,000 feet.

90. The Eastern variegated Laughing Thrush—*Trochalopterum variegatum.*

The F. B. I. says: "The eggs, four or five in number . . ."

I have found very many nests of this bird but have never found more than 3 eggs in a nest. Two or three, generally two, constitute a full clutch.

No species of *Trochalopterum* of which I have experience lays more than 3 eggs.

142. Mandelli's Spotted Babbler—*Pellorneum mandellii.*

The F. B. I. puts the distribution of this bird as "the lower hills of Nepal and Sikhim" and further east.

This bird is common in the Sub-Himalayan tract, including the Dehra Dun chiefly at about 2,000 feet.

It certainly occurs as far west as the Jumna, and probably further west, but I have no experience of the lower Punjab hills.

174. The Red-billed Babbler—*Stachyridopsis pyrrhops.*

The F. B. I. says this bird makes "a cup-shaped nest."

All nests I have ever seen have been domed and not cup-shaped.

199. Hodgsons Short Wing—*Hodgsonius phœnicuroides.*

The F. B. I. says: "This species is found at the foot of the hills as well as at considerable altitudes."

This bird breeds in numbers at from 10,000 to 11,000 feet and probably in winter descends to the warmer valleys, but I have never observed it at the foot of the hills.

202. The Chestnut-headed Short Wing—*Oligura castaneicoronata.*

The F. B. I. says of the distribution of this bird "Nepal-Sikhim; Khasi Hills . . . ." This species is not uncommon in Tehri Garhwal (and doubtless also in Kumaon) between 4,000 and 11,000 feet. It frequents dense undergrowth especially in shady ravines.

It is a resident species and breeds at low as well as at high elevations.

I have observed it west of the Tons river, but I think it unlikely to be found in the Punjab Himalayas.

235. The Red-billed Liothrix—*Liothrix lutea.*

The F. B. I. says: "This bird is found from 5,000 to 8,000 feet or lower."

In the United Provinces this bird frequents the dense jungles near the foot of the hills, where it breeds, at from 1,500 to 4,000 feet. It rarely ascends above 5,000 feet.

In the Eastern Himalaya, near Darjeeling, it ascends to 7,000 or even 8,000 feet.

335. The Hair-crested Drongo—*Chibia hottentotta.*

The F. B. I. says of the distribution of this bird "The Himalayas from Garhwal eastwards."

It is however common in the submontane Sal forests, including the Dehra Dun as far as the Jumna and I have observed it breeding up the Jumna valley at 4,500 feet elevation.

Mr. C. H. Donald has recently pointed out in this Journal (Vol. xxv., page 500) that this species occurs rarely in the Kangra valley (Punjab).

356. The Scaly-breasted Wren—*Pnœpyga squamata.*

The F. B. I. says of this bird that it occurs in the Himalayas "at considerable elevations." This is true of the summer months, for this species breeds below the snows at an elevation of from 9,000 to 11,000 feet. In the winter it descends to the submontane Sal forests and lower valleys.

371. The Spotted Bush-Warbler—*Tribura thoracia.*

The F. B. I. puts the distribution of this bird as "Nepal and Sikhim" eastwards.

It also occurs in Tehri Garhwal (and doubtless also in Kumaon) in the summer at high elevations. I found it breeding at from 10,000 to 11,000 feet.

The bird differs somewhat from typical *T. thoracia* and may possibly prove to be a distinct species.

446. The Aberrant Warbler—*Neornis flavolivaceus.*

The description given by the F. B. I. of the nest and eggs is wrong. They belonged evidently to *Horornis.*

The nest is of dry grass, domed and placed in dry grass on a steep hill side and the eggs are a uniform pale terracotta.

451. Blanford's Bush-Warbler—*Horornis pallidipes.*

The F. B. I. says of the distribution of this bird that it is found from Sikhim eastwards.

It also occurs in the Dehra Dun in the summer and breeds in the rains in the dense long grass and scrub jungle bordering the Sal forests.

It will doubtless be found in the intervening country also between Sikhim and Dehra Dun.

The eggs of this species found by me in the Andamans and also in Maymyo were a beautiful deep mahogany red.

458. The Brown Hill-Warbler—*Suya crinigera.*

The F. B. I. says the nest of this bird is a "deep cup."

All the nests I have seen have been deep and beautifully domed.

485. The Brown-backed Pied-Shrike—*Hemipus capitalis.*

The F. B. I. gives the distribution of this bird westwards to Garhwal.

I have observed it occasionally also in Dehra Dun, where, however, it is not common.

512. The Ashy Swallow Shrike—*Artamus fuscus.*

The F. B. I. gives distribution west to Naini Tal.

This bird also extends to the Dehra Dun, where, however, it is rare.

567. The Slaty-blue Flycatcher—*Cyornis leucomelanurus.*

The F. B. I. says this species is found up to 7,000 or 8,000 feet.

As a matter of fact it is migratory, being found in the plains near the foot of the Himalayas in the winter months, and in the Himalayas at from 9,000 to 11,000 feet where it breeds in the summer.

575. The Blue-throated Flycatcher—*Cyornis rubeculoides.*

The F. B. I. says of this bird that it occurs throughout the whole extent of the Himalayas up to 6,000 or 7,000 feet.

I have not observed it in the Himalayas as except rarely in the low valleys, but it is exceedingly common in the foot hills and sub-montane Sal forests, where it breeds.

598. The Indian Paradise Flycatcher—*Terpsiphone paradisi.*

The F. B. I. says of this bird: "It appears to be everywhere a permanent resident except in the Himalayas."

This remark is incorrect so far as the Dehra Dun and sub-montane tract of the United Provinces is concerned. Here this species is very decidedly migratory, appearing in April and disappearing in October.

603. The Yellow-bellied Fantail Flycatcher—*Chelidorhynx hypoxanthum.*

The F. B. I. says that this bird "appears to be a permanent resident."

In the United Provinces, at any rate, it is decidedly migratory, spending the cold weather in the foothills and sub-montane tract and summering in the high level forests at from 10,000 to 11,000 feet.

653. The Golden Bush Robin—*Tarsiger chrysœus.*

The F. B. I. says of the distribution of this bird: "The Himalayas apparently up to 5,000 feet."

This species is seldom seen so low as 5,000 feet, except in the winter ; it breeds near the snows at from 10,000 to 12,000 feet.

664. The Shama—*Cittocincla macrura.*

The F. B. I. gives the Western limit of the distribution of this bird as Nepal.

It occurs, however, as far West as Ramnagar on the Kosi (S.-W. of Naini Tal) where I have found it breeding.

698. The Small-billed Mountain Thrush—*Oreocincla dauma.*

The F. B. I. says of this bird that it breeds in the Himalaya up to 7,000 feet at least.

In the United Provinces it is found in the sub-montane Sal forests in the winter, but retires in the summer to the higher Himalayas where it breeds between 8,000 and 10,000 feet.

701. The Plain-backed Mountain Thrush—*Oreocincla mollissima.*

This species, so far as my observations go, does not descend to the plains forests in the cold weather, but winters in the hills. It breeds at from 9,000 to 12,000 feet in the Himalayas.

748. The Brown Bulfinch—*Pyrrhula nepalensis.*

The F. B. I. says of the distribution of this bird: "The Himalayas from Garhwal to Sikhim."

This bird occurs fairly commonly throughout Tehri Garhwal to the borders of Bashahr (West of the Tons) and probably into the Punjab.

It is a commoner bird than is generally supposed, but from its habit of frequenting the tops of high trees in Fir forest it frequently escapes observation.

To any one who has familiarized himself with its note it will found by no means rare in the big Fir forests at from 7,000 to 9,000 feet.

772. The Himalayan Green-finch—*Hypacanthis spinoides.*

The F. B. I. gives the distribution of this bird as the Himalayas up to 9,000 feet.

This is correct, but this species visits the plains along the foothills in the winter months in vast flocks feeding mainly on wild hemp seed.

839. The Forest Wagtail—*Limonidromus indicus.*

The F. B. I. includes the United Provinces within the area of distribution of this bird.

I have never observed it in the forests of the U. P. and if it occurs there, it must I think be very rare. I knew the bird well in the Andamans and in Burma.

887. The Fire-tailed Sun-bird—*Æthopyga ignicauda.*

The F. B. I. gives the Western limit of this Bird as Nepal. I have observed and shot it in the Tons valley (Tehri Garhwal) at about 10,000 feet.

906. The Larger Streaked Spider Hunter—*Aracnothera magna.*

The F. B. I. gives the range of this bird as from the Sutlej eastwards.

I very much doubt if it extends west of Nepal except perhaps as a rare straggler as I have never seen it in the forests of the United Provinces.

933. The Indian Pitta—*Pitta bracyhura.*

The F. B. I. gives the western limit of this bird as Garhwal. As a matter of fact they come in vast numbers to the sub-montane Sal forests as far west as the Jumna, arriving in May and remain to breed leaving again in October.

Mr. C. J. Donald has recently reported the breeding of this bird as far west as the Kangra Valley in the Punjab (*vide* B. N. H. S., Vol. XXV., page 497).

996. The Great Slaty Woodpecker—*Hemilophus pulverulentus.*

The F. B. I. is doubtful as to the western limits of distribution of this species.

It occurs as far west as the Kotri Dun in Garhwal (S. E. of Lansdowne).

It is not found in Dehra Dun.

1025. The Broad-billed Roller—*Eurystomus orientalis.*

The F. B. I. gives Kumaon as the western limit of this bird. It actually extends as far west as the Kotri Dun. (See last species.)

1092. The European Nightjar—*Caprimulgus europæus.*

The F. B. I. says of this bird: "The note is a whirring sound." This is true for Europe but not of the Indian bird which has an entirely different call consisting of chuck-chuck-chuck..... repeated 6 to 8 times rapidly at intervals of about $\frac{1}{5}$th of a second. It never produces the whirring sound so characteristic of the European bird.

It is, I have no doubt, really a distinct species (*Caprimulgus unwini.*).

1112. The Indian Plaintive Cuckoo—*Cacomantis passerinus.*

The F. B. I. says, on Jerdon's evidence, that this bird ascends the Himalayas to about 9 000 feet.

This is essentially a bird of the lower Himalayan valleys and submontane tract.

It is very common between 1,500 and 3,000 feet and rarely if ever ascends above 6,000.

1117. The Drongo Cuckoo—*Surniculus lugubris.*

The F. B. I. says that this bird occurs "as far west as Nepal."

It is common in the sub-montane tract as far west as the Jumna and doubtless occurs further west in the Punjab though I have no experience west of the Jumna.

1119. The Red-winged crested Cuckoo—*Coccystes coromandus.*

The F. B. I. gives the western limit of this bird as Nepal.

It actually occurs, though not commonly, in the low well wooded valleys as far west as Mussoorie.

1133. The Lesser Coucal—*Centropus bengalensis.*

The distribution of this bird is given in the F. B. I. as Bengal and S. India, and eastwards.

It actually occurs throughout the sub-montane forest of the U. P. in suitable places.

This year I observed several pairs in Dehra Dun breeding in the grass lands south of Dehra bordering on the Sal forests.

They appear to be migratory at any rate in the western portion of their range.

1395. The Banded Crake—*Rallina superciliaris.*

The F. B. I. says of this species: "Its summer quarters and breeding haunts are unknown."

It appears to be a regular summer visitor to Dehra Dun as I have in two successive years found it breeding here.

I understand from Mr. T. R. Bell of the Forest Service that it also breeds in the Bombay Presidency.

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A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATE AND DIAGRAMS

BY

F. WALL, C.M.G., C.M.Z.S., F.L.S., LIEUT.-COLONEL, I.M.S.

Part XXVII (with Plate XXVII and Diagram.)

(Continued from page 97 of Volume XXVI.)

HYDROPHIS SPIRALIS (SHAW).

THE NARROW-RINGED SEA-SNAKE.

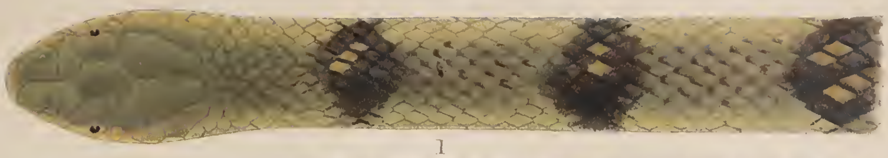
History.—The type is the young example collected by Russell, now in the British Museum, labelled from the "Indian Ocean". It was described by Shaw in 1802. In my monograph of the sea-snakes published by the Asiatic Society of Bengal in 1909 I expressed the opinion that *spiralis* (Shaw) and *brugmansi* (Boie) were identical species; and subsequently in this Journal (Vol. XX, p. 558) in 1911 substantiated this opinion by remarks upon the variations in the lepidosis, and colouration of a brood of 14 young. The snake described by Gray under the name *subcincta*, and that by Gunther as *longiceps*, both known from single specimens in the British Museum, I cannot dissociate from this species. Again the snake described by me and christened *alcocki* in 1906 (memoirs of the Asiatic Society of Bengal) I now think cannot be regarded as a species distinct from *spiralis*.

Nomenclature. (a) *Scientific.*—The generic name is from the Greek " hudor " " water ", and " ophis " " snake," and the specific title from Latin refers to the decoration of the body. This, however, is in the form of rings rather than spirals.

(b) *English.*—The narrow-ringed sea-snake fits this subject, in which the rings so commonly seen in sea-snakes are narrower than in the other species, at any rate those within Indian seas.

(c) *Vernacular.*—Tamil fishermen do not discriminate between the various kinds, and call most sea-snakes " kadel nagam " or " sea-snake."

Identification.—The most reliable and at the same time simple way that I can suggest to identify this species is by counting the costal rows two heads-lengths behind the head, and the same distance before the anus. In no other sea-snake (excepting the species of *Platurus* and *H. jerdoni*) are the rows posteriorly so few in excess of those anteriorly. In the latter spot they range between 25 and 31, and posteriorly only number 2 to 6 more, whereas in other species the posterior count is from 10 to 20 in excess of the



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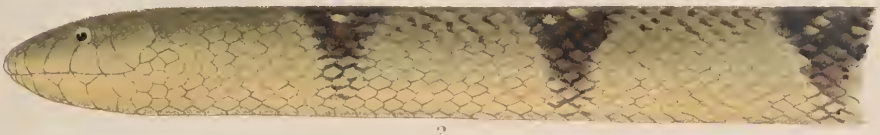

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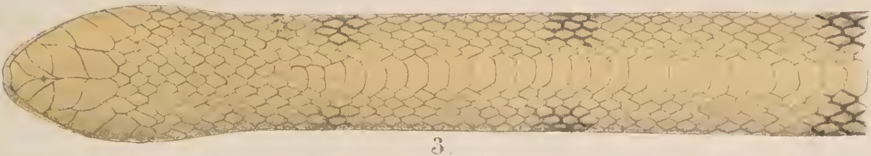

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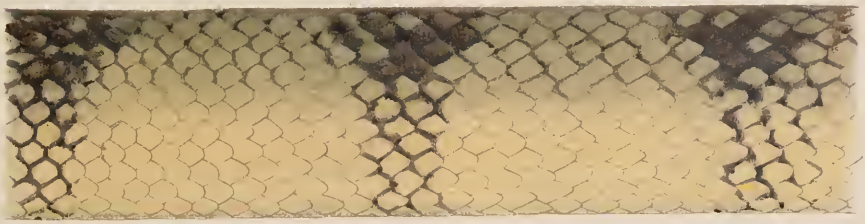

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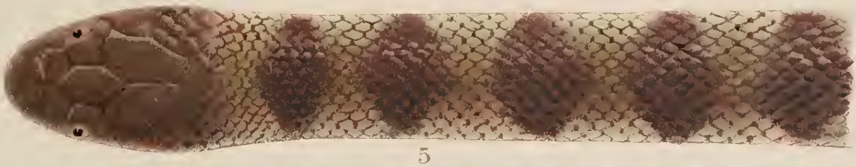

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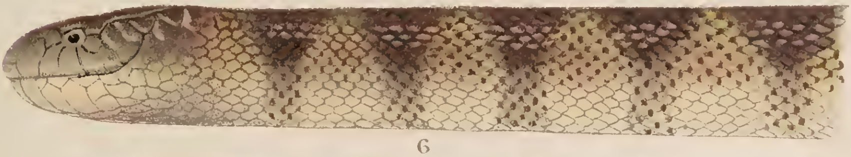

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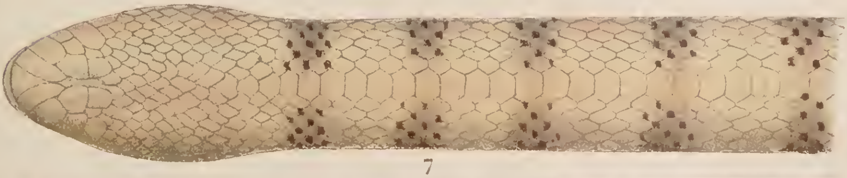

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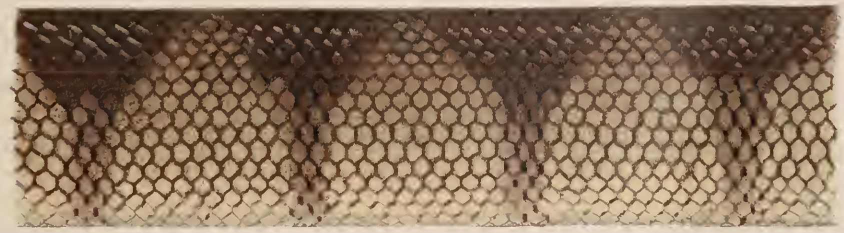

8.

P Gerhardt del. J. Green, Chromo.

THE COMMON INDIAN SNAKES (Wall.)

1-4. Distira spiralis, var. brugmansii, *poisonous*. 5-8. Distira cyanocincta, *poisonous*.

all nat. size.

anterior. A common though not invariable shield character is the large temporal which usually descends to the border of the lip (see figure A. in diagram).

General characters.—For a sea-snake, it is of conspicuously robust habit and unusually elongate. The calibre of the body anteriorly is but little less than that posteriorly. Anteriorly it is cylindrical, posteriorly but little compressed. The head is large with strong jaws, and the tail as in other hydrophids is a strongly compressed fin.

Colour and markings.—The back is usually a dull greenish or bluish hue fading about midcosta, where the lower half of the snake becomes uniform yellow or buff. The body is usually encircled, with from 34 to 59 black or blackish bands, often expanded vertebrally and ventrally, but these may be replaced by dorsal bars, the arrangement being very variable. The specimens may be grouped as follows:—

(*A*) Body banded.

(*a*) Variety *brugmansi* (Boie). With bands much narrower at midcosta than the intervals. No vertebral nor ventral spots. With this I place *robusta* (Gunther), *bishopi* (Murray), and *melanocephalus* (Gray). The commonest variety, from the Persian Coast (Gangestun and Muscat) to the Malay Archipelago (Penang).

(*b*) Variety *typica*, vel *spiralis* (Shaw). Differs from the last only in exhibiting vertebral spots in one, many, or in all the interspaces. When few, these are usually seen in the foremost, and posterior spaces. Common from the coast of Sind to Madras.

(*c*) As the last with a similar series of ventral as well as vertebral intermediate spots. I know only one specimen which is in the Colombo Museum, presumably from the Ceylon Coast.

(*d*) Variety *melanosoma* (Gunther). Bands at midcosta as broad or broader than the spaces, dilated both vertebrally and ventrally so as to be more or less confluent in these regions. I place also *floweri* (Boulenger), and *alcocki* (Wall) with this which is an unusual form.

(*B*) Body barred.

(*e*) Variety *subcincta* (Gray). The dorsum is barred and these bars are interrupted near midcosta so as to leave a series of spots on the side of the body. An unusual form, the type of which comes from the Indian Ocean.

(*f*) Variety *longiceps* (Gunther). With dorsal bars, broader than the interspaces, and no costal spots. *Temporalis* (Blanford) I also place with this. It is uncommon. I have seen specimens from Bombay and Karachi.

(*C*) Body banded anteriorly, barred posteriorly.

This form is intermediate between A and B. Such a specimen was sent by Dr. Henderson to the British Museum from Madras.

Habits.— As one would expect from its conformation, it is strong and active. It swims with vigour, and from its large size might prove a very disagreeable foe to encounter in the water. An amusing account of the capture of a giant specimen appeared in this Journal in 1913 (Vol. XXII, p. 403) over the signature of Mr. Stone, the Chief Officer of the P. and O. Steamer Arcadia.

Food.—I have lately had several specimens and submitted the curious elongate fish which they had fed upon to Dr. Henderson for identification. These fish were eel-like in conformation, and were pronounced the young of a muræenid, either *Ophichthys boro* (Han.: buch:) or *O. orientalis* (McClelland).

Breeding.—For the only domestic occurrence known to me I am indebted to Dr. Henderson. On the 1st June 1910 a large gravid ♀ was caught in Madras, and submitted to me with its unborn brood of 14 for my examination. The brood in an advanced stage of development included 10 males and 4 females. The males (with genitals extruded) measured 10½ to 11½ inches, and the females 10¾ to 11¼ inches.

Length.—The young are probably about 15 inches long at birth, judging from specimens of this length in which the umbilicus is open. Adults usually range between 4½ and 5½ feet, and specimens over 6 feet occur, but are unusual. Dr. Henderson's gravid ♀ alluded to above measured 8 feet 3 inches. Mr. Stone's specimen from Penang to which a reference has been made, was 9 feet in life and the skin when I measured it had shrunk to 8 feet 9 inches. This is much the largest sea-snake I have ever heard of, and such a monster might very easily have been the foundation for the story of "*the* sea-snake," now I suppose universally discredited. A snake always appears to be a great deal longer than actual measurement reveals. Only lately Dr. Henderson showed me a python's skin in the Madras Museum. A friend knowledgable in snake matters was asked to compute its length as the snake lay alive in the vivarium, and estimated it at about 26 feet. When dead it proved to be 16 feet.

Poison.—Nothing is known of the toxicity of this venom. No casualties in the human subject have been reported, and the poison has not been experimented with in the laboratory.

Distribution.—From the Persian Gulf to the Malayan Archipelago.

Lepidosis.—Rostral—Broader than high. *Nasals.*—In contact behind the rostral; the suture from the nostril, when present passes to the 2nd labial. *Præfrontals.*—With rare exceptions touch the 2nd labial. *Præocular.*—One. *Postoculars.*—One (rarely two). *Temporals.*—One large anterior, succeeded by a posterior of equal size; the anterior frequently descending to the margin of the lip. Rarely there are two superposed anterior temporals, and the posterior shield is not infrequently replaced by small scales. *Supralabials.*—6 to 8: the anterior 4, 5 or 6 usually large and undivided, the rest divided. The 3rd and 4th usually (rarely the 5th also) touch the eye. *Infralabials.*—4; the last in contact with 3 or 4 scales behind. *Marginals.*—Usually one wedged between the 3rd and 4th infralabials (rarely two after the 3rd). *Sublinguals.*—Two well developed pairs, the fellows of each in contact (or the posterior separated.) *Costals.*—Two headslengths behind the head, usually 25 to 29 (rarely 23 to 31); in midbody usually 31 to 35 (rarely 29 to 36); two headslengths before the anus 28 to 36: more or less imbricate, smooth or nearly smooth in the young, feebly or strongly tuberculate in adults. *Ventrals.*—282 to 373. Entire throughout except for a few posteriorly; less than twice or hardly twice the breadth of the last costal row.

Dentition.—I have examined the *maxillary* teeth of well over a dozen examples, and find there are usually 7 (rarely 6) behind the paired fangs. *Palatine.*—7. *Pterygoid.*—12 to 13. *Mandibular*—13 to 15.

Plate.—Our figures are excellent, and show the commonest form, (Variety *brugmansi*) to be met with around our coasts. The ventrals are shown too broad relatively.

*HYDROPHIS CYANOCINCTUS** (DAUDIN).

THE CHITTUL.

History.—The type of this species I take to be the specimen in the British Museum from the Sunderbunds, which was one of the collection originally presented by Russell to the Royal College of Surgeons. This specimen is probably the subject from which figure IX Russell's second volume published in 1801 is taken. The name *cyanocinctus* was conferred by Daudin in 1803.

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* I have no hesitation in declaring the *tuberculata* and *crassicollis* of Anderson, the *dayanus* of Stoliczka, and the *trachyceps* of Theobalds (all of which are known from single specimens in the Indian Museum which I have examined) identical with *cyanocinctus*. Further I think the *sublævis* and *lapemidoides* of Gray, all of which I have examined in the British Museum, will prove to belong to this species. It is more than likely too that the *melanocephalus* of Gray, and the *melanosoma* of Gunther may have to be referred to this species. I have seen the types of each in the British Museum. The *bituberculata* of Peters I have not examined, but I see no reason from the description and figure given to dissociate it from *cyanocinctus*.

Nomenclature. (*a*) *Scientific.*—The generic name is from the Greek signifying "water snake," and the specific is a hybrid word of Greek and Latin origin meaning "blue banded."

(*b*) *English.*—One cannot do better than appropriate the vernacular name for English use.

(*c*) *Vernacular.*—According to Russell "chittul" is the name by which the snake is known to the natives about the Sunderbunds, but I very much doubt if they can really discriminate between this and many other sea-snakes. The word is probably a derivative of "chitti" implying spotted or mottled.

General Characters.—The adult is a strongly built and heavy snake. The forebody is cylindrical, and varies from about two-fifths to two-thirds the depth of the body at its greatest girth, except in heavily gravid females where it may be only one-third. Posteriorly the body is compressed, and the tail is flatly compressed as in other sea-snakes. The head, of the same calibre as the forebody, is relatively large and the jaws strong.

Colouration.—The many varieties have been summed up by Mr. Boulenger, and I have little to add to his arrangement.

Variety (A),—*typica* (Daudin). With well-defined black bands, more or less connected ventrally.

(*a*) All the bands complete. A common form ranging from the Persian Gulf to Tenasserim.

(*b*) With some of the posterior bands interrupted costally or subcostally. Not uncommon. From the Persian Gulf to Tenasserim.

(*c*) With some of the posterior bands deficient ventrally, and thus converted into bars. Not uncommon. From the Persian Gulf to Tenasserim.

Variety (B).—With well-defined black bands not united ventrally. A common form occurring between the Persian Gulf and Tenasserim.

Variety (C).—With obscure bands or bars. A common form usually met with in adult specimens, and occurring between the Persian Gulf and Tenasserim.

Variety (D).—With well-defined dorsal bars. A common form seen in examples from the Persian Gulf to Tenasserim.

Variety (E).—The *phipsoni* of Murray. With a continuous, black dorsal band. A rare form known from a single specimen from Bombay, in the Bombay Natural History Society collection.

Identification.—Given a normal specimen identification is easy. A large majority of specimens will be found to have the 3rd, 4th and 5th labials entire, and all touching the eye. In addition there is nearly always a complete row of marginals after the 2nd infralabial, which cuts off the subsequent infralabials from the margin of the lip. Unfortunately in many specimens certain of the head shields are subject to great variation. Thus only two labials may touch the eye, and either the 3rd, 4th, or 5th or all, may be divided. Rarely specimens have a single cuneate marginal between the 3rd and 4th infralabials, or a complete row after the 3rd infralabial. The ranges of costal rows and ventrals are considerable. These facts make identification in some cases difficult, in fact many new species have been created by various authors, on individuals that present a number of costals or ventrals in excess of the previously recorded ranges cr that present unusual characters in their head shields. Where only two labials touch the eye, the costals and ventrals must be counted, and these may come within the ranges of the following species, *nigrocinctus*, *diadema*, *mamillaris*, and *cœrulescens*. An examination of the maxillary teeth is then called for, and this is best left to an expert. *In nigrocinctus* there are 2 teeth behind the fangs, in *cyanocinctus* 6 to 8 (usually 7), in *diadema* 8 to 10, in *mamillaris* 9 to 10, and in *cœrulescens* 13 to 17.

The species is, however, more frequently confused with *spiralis* (Shaw) (vel *brugmansi* (Boie)), than with any other species. The most important points of difference between these two are, that in *spiralis* the scale rows at the greatest girth range from 29 to 36, whereas in *cyanocinctus* they range from 38 to 49. Further the scale rows in *spiralis* are usually only 2 to 6 more numerous at the greatest girth than in the forebody, whereas in *cyanocinctus*, they are usually from 8 to 16 more numerous.

Habits.—Nothing special has been recorded about the habits of this snake in spite of its being such a common species.

Breeding.—A small specimen only 2 feet 11 inches long, in the Indian Museum, I found gravid. The date of its capture is not recorded. It contained 3 fœtuses, varying in length from 1 foot 2 inches to 1 foot 3 inches.

Another gravid specimen captured in the Bombay harbour, I found contained 9 young. The parent measured 4 feet 4 inches, and the young of which, 4 were ♂, and 5 ♀, varied from 12 to 13 inches in length. The date of capture is not known.

Fayrer, in his Thanatophidia, mentions a gravid specimen from Puri (date not recorded) in which Mr. Stewart found sacs of the size of hen's eggs, containing 16 very young embryos. A gravid female 33 inches long, captured in the Chantabum River, Siam, in

March 1916, contained eight embryos varying in length from 10 to 10½ inches.

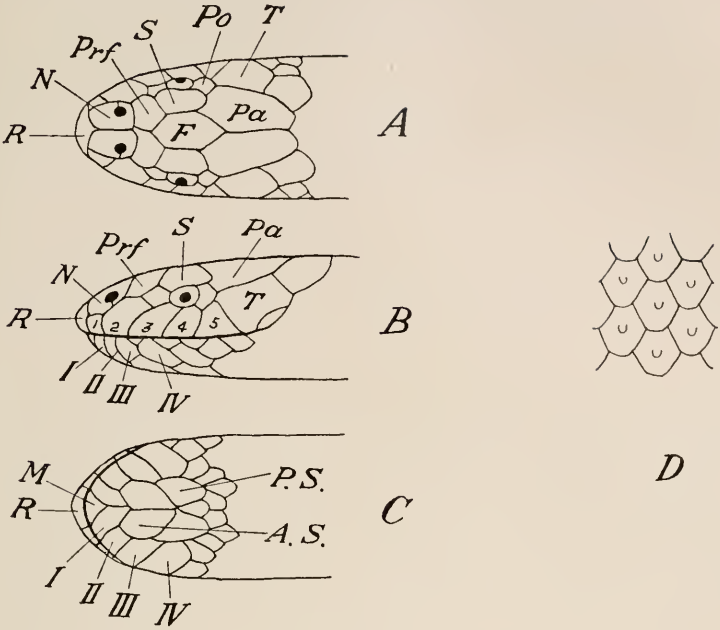
Poison.—Nothing is known. There is no record of a bite in the human subject, but the poison may be judged to be virulent, from the fact that a fowl that Russell caused to be bitten by a five-footer succumbed in 8 minutes.

Lepidosis.—Rostral.—Broader than high. *Nasals.*—In contact behind the rostral. When there is a suture from the nostril this passes to the 2nd labial. *Præfrontals.*—Touch the 2nd labial. *Frontal.*—The sutures with the parietals are rather longer than with the supraoculars. *Supraoculars.*—In length and breadth about two-thirds to three-fourths that of the frontal. *Præocular.*—One. *Postoculars.*—Usually two, sometimes one. *Temporals.*—Usually two between the parietal and the 6th labial. *Labials.*—7 to 8. The first 5 usually entire and the 3rd, 4th, and 5th usually touching the eye. *Infralabials.*—5; the 3rd and 4th broadest, the 5th touching 3 or 4 scales behind. *Marginals.*—Usually a complete row after the 2nd infralabial, rarely, a single cuneate, or a complete row after the 3rd infralabial. *Sublinguals.*—Two pairs, the fellows of each in contact or the posterior rarely separated. *Costals.*—Two headslengths behind the head 27 to 36; at the greatest girth 38 to 49. Anteriorly imbricate, posteriorly imbricate, sub-imbricate, or juxtaposed. Each scale has a keel occupying its median three-fifths or so. Almost always this keel is divided by one or two indentations into two or three parts. The very distinctive keels and their serrations are much more conspicuous in males where they are sometimes most pronounced and even spinous on the belly. In females and young though somewhat obscure they are usually discernible if looked for. *Ventrals.*—296 to 398, usually entire, rather less than twice the breadth of the last costal row, keeled on either side like the lowest costals.

Dentition.—Maxilla.—In well over 20 specimens examined I find there are nearly always 7 teeth behind the fangs, but they vary from 6 to 10. The numbers of mandibular, and other teeth given are from the single skull in my collection and are: *Palatine.*—9. *Pterygoid.*—18. *Mandibular.*—14 to 17.

Length.—Adults are usually 4 or 5 feet long, the largest in the British Museum being 4 feet 10 inches. I doubt if I have ever seen one 6 feet, but Murray says it grows to 7 feet. Judging from the length of the young compared with those of *spiralis*, one would expect to hear of as large or even larger specimens than in that species.

Distribution.—In Indian limits it occurs from the Persian Gulf to Tenasserim. It is probably the common set sea-snake on our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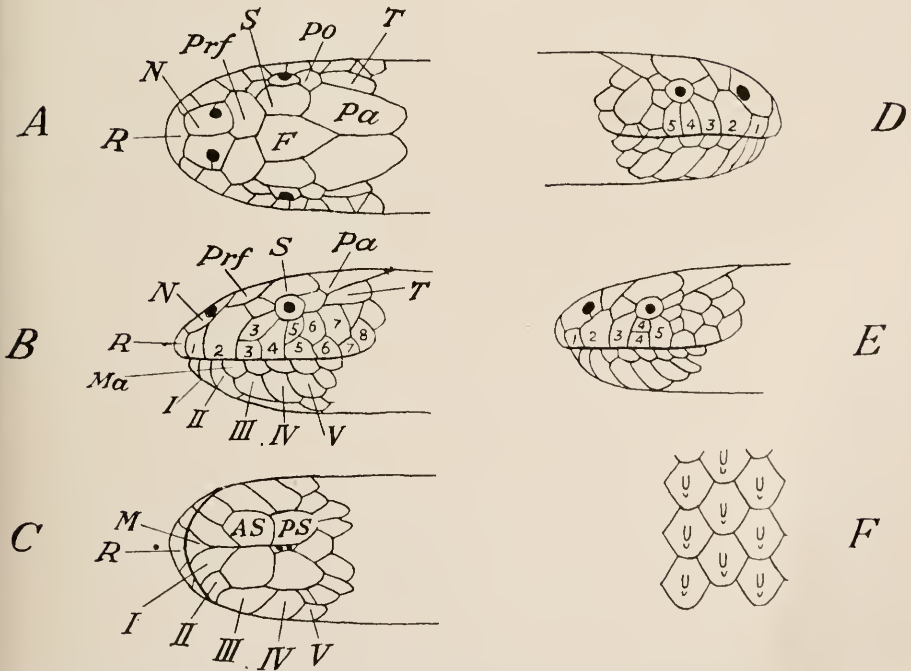
Hydrophis spiralis A,B,C.(nat:size) D (x 2)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Hydrophis cyanocinctus AtoE (nat:size) F (X 2)

shores with the single exception of the Jew's nose (*E. valakadyn*). In the Persian Gulf it is probably the commonest of all sea-snakes. About Ceylon it appears to be much less abundant than on the shores of India. I can find no record from the Andamans, though one can hardly doubt that it occurs there.

Plate.

On the coloured plate the names of the snakes are given as * *Distira spiralis* var *brugmansii* and *Distira cyanocincta*; these should now be changed to *Hydrophis spiralis* var *brugmansii* and *Hydrophis cyanocincta* respectively.

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* In my "Monograph of the Sea-snakes" published in the Memoirs of the Asiatic Society of Bengal in 1909, I pointed out that the genus *Distira* (Boulenger) rested on a mistaken basis. I contended that the posterior maxillary teeth in *all* Hydrophis were grooved, and Boulenger was in error in supposing these teeth in *Hydrophis* were not grooved. This being the only difference on which the two were separated I claimed that they should rest under a single generic title. Since this Boulenger has published a work on the Malayan Reptilia, and in this he has accepted my observations and *Distira* now is suppressed in favour of *Hydrophis*, for all those species previously included by him under *Distira* and *Hydrophis*.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I.F.S.

(*Continued from page* 140 *of Vol.* XXVI.)

PART XXII.

(With Plate H.)

18. Genus—IRAOTA.

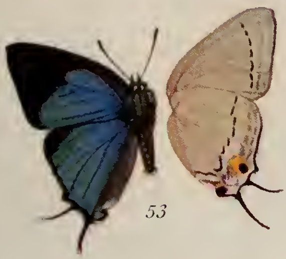
De Nicéville says that this genus and *Amblypodia* are structurally the most aberrant of the India *Lycænidæ*, because of the veins 7, 8, 9 being stalked and 9 being wanting in the female. *Iraota* is further characterised by the size of the butterflies: 1·5 to 1·8 inches in expanse, by the brilliant metallic blue of the male upperside and by the highly variegated chestnut underside in both sexes with prominent silvery markings; the males have, besides, a lobe and only one thread-like tail to the hind wing, while the female has a lobe and two. The genus occurs almost throughout India except in the desert tracts and the higher Himalayas; in Ceylon; in Burma; the Malay Peninsula; Java; Borneo; the Philippine Islands and China. De Nicéville states that there are three species, two of which are confined to Malay. The transformations of *timoleon* (=*mæcenas*) are described below:—

163. **Iraota timoleon**; Stoll.—Male. *Upperside:* both wings black, the lower discal area of the fore wing (this has little hair-fringe on inner margin) and the disc of the hind wing rich, deep, metallic blue, changing to purple in certain lights and varying in extent on both wings. *Underside*: both wings chocolate red-brown or chestnut. Fore wing: with the following silvery markings:—a club-shaped mark in the cell from base outwards over vein 7 but not touching the subcostal nervure and reaching a little beyond the middle; a large rounded spot on the discocellular nervules; a discal series of four inwardly angulated lunules in interspaces 2 to 6 in a straight line under each other, the middle one obsolescent, the two uppermost the smallest; a broad band of darkish suffusion from base along middle of wing to nearly the outer margin; inner margin pale, with a tuft of hairs near the middle. Hind wing: with a very prominent, curiously-shaped, silvery band extending from the base where it is narrow, suddenly broadens, has a point upwards and a lobe downwards, then narrows and turns upwards to expand into another large lobe near the middle of the costa; a small silvery spot below the band on the upper discocellular nervule and two angulated, outwardly-curved, pale whitish, ante-and post-medial lines, indistinct beyond and diffuse from the abdominal margin across wing, as also a terminal and subterminal, indistinct, whitish line; anal lobe black with a long, somewhat broad, black tail tipped with white at the end of vein 1 and a point at veins 2 and 3.—Female. *Upperside*: both wings purplish-brown. Fore wing with a large lower, discal patch of shining, generally metallic purple of variable size. Hind wing sometimes with a small, irrorated patch of purple scales in the middle of the disc. *Underside*: both wings similar to the male but all the markings more prominent. There are medium-sized extra points at the end of vein 2. Antennæ black, the club round with tip pale, orange-red; head and body black above, brown beneath; palpi white beneath; eyes ringed with white, frons white with brown hairs; *cilia* white and brown in patches.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

EXPLANATION OF PLATE H.

Figs. 53, 53 a,	Tajuria cippus	♂	♀
,, 54, 54 a,	Virachola isocrates	♂	♀
,, 55	Loxura atymnus	♂	
,, 56, 56 a,	Curretis thetis	♂	♀
,, 57, 57 a,	Arhopala centaurus	♂	♀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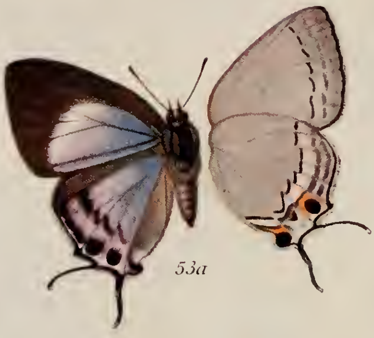
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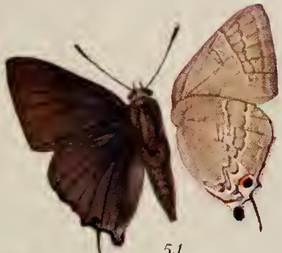
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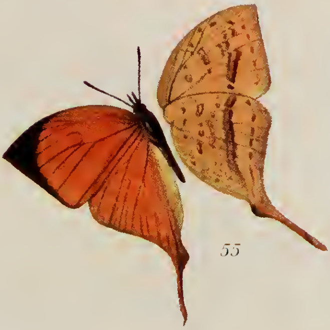
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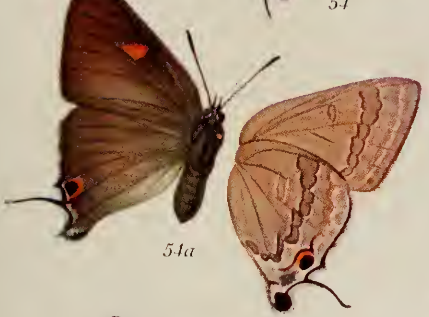
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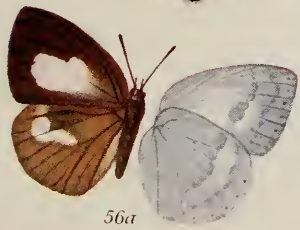
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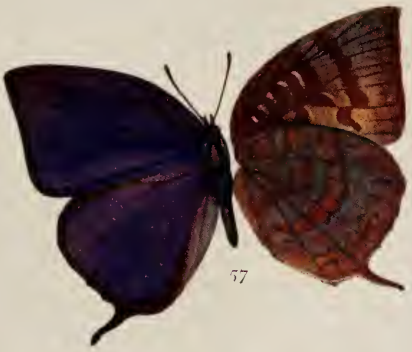
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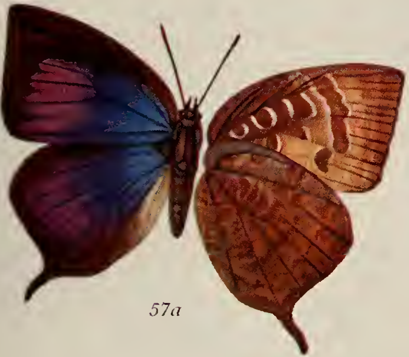
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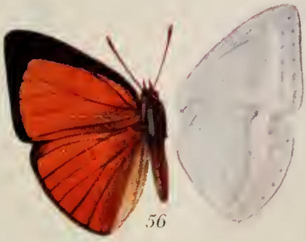
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THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Horace Knight, del. *Hentschel-Colourtype.*

In *mæcenas*, the so-called dry-season form, the prominent, silvery band on the underside of the hind wing is wanting, though indicated by scaling.

The blue on the upperside of the female is very variable both in extent and brilliance on both wings and is occasionally as extensive and as brilliant as in the male.

Expanse: male, 37·45 mm; female, 37·47 mm.

Egg.—In *shape* is a much depressed hemisphere, broadest at the base. The *surface* is shining and covered with coarse and moderately low-walled, hexagonal cells about 0·125 mm. in diameter between the walls, these walls themselves being 0·05 mm. in width and rather less in height; there are four cells from apex to base, not including the micropyle-depression at its bordering wall; the cells are arranged in very fairly regular transverse rows and there are about 24 round the largest circumference; the micropyle-depression is rather less in width than a cell-diameter and very deep, the coarse wall around it sometimes deeply pitted with a single circle of small pits or points. The bottoms of the cells are shining, and rather coarsely tuberculate, though distantly so. The *colour* as seen at the bottoms of the cells is honey-yellow; the walls, are all enamel-white and the intersections appear to be very slightly raised. B: 1·4 mm.; H: 0·75 mm.

Larva.—Onisciform, somewhat abnormal in *shape*; segment 2 large, hiding the head, semi-circular in outline, very slightly thicknened along the margin, sloping considerably up from front to hinder margin and with a rather large, square, dorsal depression with a flat bottom and a black, diagonal (to the square) dorsal line across it; segments 3, 4 progressively larger, broader and higher, 5, 6 nearly as broad as 4 and nearly as high, the succeeding segments gradually decreasing in width and height to anal end, the last segments rather suddenly narrower, the extremity square; the dorsoventral margin slightly flanged, the segments all well-marked; the gland on segment 11 large, trough-shaped with a black mark in the centre, the organs on segment 12 circular-mouthed, protruding on occasions a small, white cylinder. The *head* is round, light yellow in colour, shining, with dark mandibles. The *surface* is thickly studded with minute tubercles, each bearing a very short, erect, dark bristle or hair, some fine hairs on the ventral surface laterally also. *Spiracles* rather large, depressed, oval, light in colour. The *colour* of the body is different shades of green more or less suffused with pink or rose; a dark, dorsal line; ventrum light green; sometimes segment 9 is darker than the rest. L: 22 mm.; B: 8 mm.

Pupa.—The *shape* is quite normal; stout, rounded in front and behind, the thorax slightly humped, head hidden under segment 2, the constriction behind the thorax very slight. *Surface* slightly shining, minutely rough and covered with minute, erect hairs; a lateral row of small depressions on abdomen, one to each segment, segments 8—11 with a small swelling dorsally. *Spiracles* raised, oval, rather large, light brown in colour; that of segment 2 whitish, longly oval, rather large. The *colour* of the pupa is brown with a pinkish shade and darker brown markings. L: 15 mm.; B: 7 mm.

Habits.—The egg is deposited on branches, leaf-buds, &c., always singly. The larva lives on the young shoots and young leaves, boring into the leaf buds and fruits but never living inside them; there is nothing exceptional about its habits. The pupation takes place on a branch or in the axil of a leaf, &c., and the attachment is normal though the tail-attachment is very strong compared to the band, so that it often seems as if the pupa were attached by the tail only. Ants occasionally are found with the larvæ but do not seek them out and are certainly not necessary to the caterpillar's existence. The butterfly is strong and quick on the wing but never flies far at a time, is not always quick in getting up and drops suddenly on to a leaf or settles on a stalk, twig, &c., where it walks about slowly. It rests also in similar places and keeps the wings closed over the back; it rarely is found basking and does not seem to feed much on flowers or sip moisture from the ground. It lives amongst the foliage of the trees but is not found much in the open as distinct from the protection of leaves, &c.; it has a moderate liking for the sun but is not found in deep shade either. Both forms *timoleon* and *mæcenas* have been bred, the former in the monsoon months and end of the hot weather when the shoots are all young and succulent, the latter in the cold weather when food for larvæ is not so plentiful nor so full of sap. The foodplant of the caterpillar is *Ficus bengalensis* or Wad, the common Banyan; but it has also been bred from *Ficus glomerata* where it was found feeding on the fruits; and, no doubt, it also eats other figs. The butterfly is not rare where it occurs but it is difficult to come by owing to its habit of keeping amongst foliage and its unwillingness to feed on flowers; the larvæ can always be had in numbers. The habitat has been given under the Genus; and it may be added that it is further confined to the hills and places of heavy or moderately heavy rainfall.

19. Genus—SURENDRA.

There are three species known: *S. quercetorum* with a very wide distribution: the only one that concerns us here; *amisena* from Burma, Singapore, Nias Island; and *florimel* from the Tavoy District in Burma. This last has no tails to the hind wing; the other two have one tail in the male, two in the female. The undersides are marked in a characteristic manner and have the appearance of "cloudings" rather than definite lines, bands and spots as in the rest of the *Lycœnidœ*. The transformations of *S. quercetorum* only are known. They are given below. The larva is somewhat abormal in shape; the pupa is more or less normal. The genus is represented in the Himalayas, Southern and Eastern India, Burma, Ceylon, the Malay Peninsula and the Islands of Nias and Java which is the range of *S. quercetorum*.

164. Surendra quercetorum, Moore.—Male. *Upperside*: both wings dark-brown, the middle of the wings from base outwards for more than half the length, including the cell above and as far as vein 1 below, shining violet-purple. Fore wing: a fringe of brown hair along the inner margin; the *cilia* dark-brown at base, lighter beyond. Hind wing: the purple often entirely wanting, the brown rather paler than in upper wing; often a fine, terminal, darker line, the *cilia* as on fore wing. A 3 mm. long, narrow, ribbon-like tail at end of vein 1, a point of scales at end of vein 2; the tail black, tipped white. *Underside*; light greyish-brown with sinuous, dark-brown, fine, transverse lines and spots: the termen of the fore wing clouded darker except at apex, this clouding extending inwards triangularly but not reaching the centre of the disc; on the hind wing a similar, darkish-brown clouding occupying most of the apex and extending in a narrowing band across to the inner margin where it is bordered below by the medial, transverse line of lunules. Fore wing: with the following dark-brown markings :—One straight across middle of cell, linear with a broken continuation above between vein 12 and cell; one on each side of the discocellular nervules, close together, straight, sometimes converging at the ends; a short, outwardly-curved lunule in interspaces 11, 10, 9 just under the costa and each one in succession further out than the preceding; the outermost one of these forming the upper end of a postdiscal series of similar markings in the interspaces down to vein 1, the third moved inwards and broken from the line, the fourth, fifth and sixth continuous amongst themselves but broken from the rest and moved outwards in a curve, the seventh and eighth straight; a subterminal series of small, round spots from interspace 1 to 6; a dark, fine anteciliary line sometimes edged finely paler inside; the *cilia* dark-brown at base, pale beyond. Hind wing: a subbasal line of lunules from vein 7 to vein 1, all inwardly bordered thinly with white, the line broken and curved; a pair of discocellular lines as on fore wing but fainter; a medial, curved, transverse line of outwardly convex lunules in the interspaces from 7 downwards broken inwards in interspaces 5, 6 and again in 3, 2, &c., these lunules being very highly curved: all edged outwardly with white but most prominently in the upper part of the line; a postdiscal series of inwardly-convex, similar lunules forming a continuous line from vein 7 to the inner margin above anal lobe, the last lunule running up parallel to the inner margin; a series of submarginal spots as on fore wing, often very indistinct; an anteciliary, dark-brown, fine line edged inwardly finely white as on forewing; *cilia* also as on fore wing; the anal lobe often dull orange-brown. Female.—With one extra tail, to the end of vein 2, shorter and broader than the longer one at end of vein 1. *Upperside:* both wings glossy, smokey brown, varying in shade with a purplish tint at times. Fore wing: the middle of disc often paler; *cilia,* darker brown. Hind wing: similarly brown; *cilia* often lighter towards anal angle. *Underside:* as in the male exactly except that the orange on the anal lobe is brighter. Antennæ, dark-brown above, speckled with white below, with the bluntly pointed, rounded club orange; frons brown, darker above; palpi, head thorax and abdomen darkish-brown above; below everything light-brown. Expanse: 41 mm. and under.

The males are often only 26 mm. in expanse; the undersides are then rather faintly marked, the subterminal lunulate spots and postdiscal lines of the hind wings being particularly affected.

Egg.—Depressed hemispherical in shape, covered with coarse, conical, round-topped risings each one connected with those surrounding it by fine, low ridges; hardly two of the risings are the same size, the largest being situated round the greatest breadth of the egg; on the summit is a lace-work of thick-walled cells without any thickening at the intersections of the lines and the micropyle is a small perforation in the centre; the ground-colour is green, all the walls and thickenings are white. B: 0.8 mm. H: 0.4 mm.

Larva.—The *shape* of the larva is not normal, being rather lengthened, depressed and parallel-sided. The *head* is hidden under the large second segment at all times; this segment 2 is more or less semi-circular in outline with the dorsum taken as a whole parallel to the longitudinal axis of the pupa but sloping up towards the much higher segment 3 at the hinder margin, has the middle of the dorsum depressed to form a diamond, of which the greatest length is on the dorsal line and of which the surface is shining, the margins of the segment thus being thickened all round the free part but having the dorsal line of the front deeply depressed so that the thickened margins of each side end in what looks like a small subdorsal knob; segment 3 is very little broader than segment 2 but a good deal higher; segment 4 is broader than 3 and forms the highest part of the larva and the breadth remains the same thence backwards o segment 9, the height very gradually decreases backwards to segment 10;

the dorsal slope of segments 11-14 is more considerable, the 14th or anal segment being suddenly narrower than the preceding one and ending square behind; there is a kind of fleshy tooth at the common margin of segments 12 and 13 on the dorsal surface of which are situated the extensile organs of segment 12 which, when protruded, are short cylinders with tubercled, knob-like extremities; the gland on segment 11 is circular in shape; on the dorsum of segment 14 there is a depressed, shining, glabrous, central, large, green space. The head is roundish, shining, light red-brown in colour with black mandibles. The dorsoventral margin is more or less flanged, the flange rounded in transverse section and more or less translucent-looking. The *surface* of the body is covered with minute, curved, thick-topped hairs, the ventrum with minute tubercles; the posterior margin of segment 14 and front margin of segment 2 are set with simple, erect hairs and there is a single, curved, erect hair at each lateral angle of the dorsal depression of segment 2 as well as a single, subdorsal one on the middle of each segment 5-9. The *spiracles* are the colour of the body, white-centred and of ordinary size, circular. The *colour* of the body is light green or rose, with a double, lateral, diagonal band to each segment 5-10 running down and back, the posterior half of each band being dark-green, the front half whitish; there is a broad, dark green, lateral band with the upper edge white-bordered on segments 2-4, that on segment 2 being narrowest; a dark-green, dorsal line from end to end; the anal segment has two subdorsal, whitish bands as well as a dark-green dorsal one; segment 2 has a dark-green, dorsal band; besides which there is a subspiracular greeny-white or rose-coloured band; all the diagonal lateral bands end on the subdorsal line and do not meet on dorsum; ventrum dark-green. L: 20 mm; B: 5 mm; H: 4 mm.

Pupa.—The shape is quite normal, the anal end being rounded, the front also; the head is hidden under segment 2; segment 2 transversely convex with a considerable dorsal slope which passes smoothly into the similar dorsal slope of of thetransversely convex, slightly laterally compressed thorax which is somewhat broader than segment 2 with rounded shoulders; the breadth of pupa is the same from the shoulders to segment 7 so that the lateral outline is there straight; anal segment slightly turned under; the ventrum of pupa flattened. The *surface* of the pupa is minutely roughened with minute mushroom-shaped hairs, *i. e.*, hairs with thick stems and circular, disc-shaped tops; on segment 2, there is a subdorsal, central, minute, conical tubercle. *Spiracles* of segment 2 prominent, oval, white; the rest are glassy, prominent, oval, light-coloured. The *colour* of the pupa is dark brown-pinkish, blotched with blackish; a blackish dorsal line and a lateral row of large, glassy, black, depressed, circular spots, one to each abdominal segment; ventrum light. L: 12 mm.; B: 4.5 mm.; H: 4 mm.

Habits.—The single egg is deposited upon shoots, stalks, leaves after a minute inspection of sites by the butterfly and, often, amongst a lot of ants that stroke her legs with their antennæ. The little larva, upon emerging, eats only the young parts and seems to be particularly fond of the gland at the base of the leaf which is found in *Acacia pennata* upon which it is always found. When full grown and in the last few stages the caterpillar is difficult to find because of the cryptic colouring, the diagonal bands having the appearance of the rows of little leaflets along the branches of the leaf. The pupation takes place in a crevice or on a leaf, on the upper surface or below as the case may be, &c.; and the fixings are quite normal. The butterfly can fly quite strongly but never goes far; it gets up when disturbed, flies a short distance and then suddenly drops amongst the foliage. It frequents jungles where the rainfall is heavy and the country hilly and does not extend into the plains or dry places ; it likes the sun, but does not bask ; neither is it commonly to be found feeding at flowers or drinking water on the ground, it rests with the wings closed over the back and generally on an erect shoot, twig or stem ; it is sluggish in getting up. The distribution is that given for the genus. It is plentiful on the Western Ghats from sea-level up to 2,000 feet in the Kanara and Belgaum Districts of Bombay.

20. Genus—MAHATHALA.

There is only one species, *ameria*, which constitutes this genus. It is characterised by having a spatulate tail to the hindwing, the outer margin of the hind wing being much lengthened and the costal margin very short and excised so that the apex is a regular point or tooth. Otherwise it is very like an *Arhopala* in general appearance and in the markings of the underside. It is not a common butterfly anywhere. Its life history is unknown.

165. Mahathala ameria, Hewitson.—Male. *Upperside*: dark, dull purple. Fore wing with the costal and outer marginal bands narrowly black but not prominently so; broader on the outer margin than on the costa, broadest at apex. Hind wing with a broader, inconspicuous, black band from the base along the costa, where it is broadest and round the outer margin evenly to the anal angle ; tail at the end of vein 2 black, rather long, broad, spatulate, scalloped on each side so as to form a short, tooth-like projection. *Underside :* fore wing with the upper half suffused with rufous-brown, the apex smeared with whitish, the lower half of the wing pale greyish-brown ; a broad bar across the middle of the cell and another across the end formed by their white edgings, an irregularly angled spot edged with white below the end of the cell, a broad, discal band of conjoined spots from the costa to vein 2, edged with whitish, commencing from the costa in an outward curve, then nearly straight down ; indications of a submarginal series of indistinct, brown, lunular marks. Hind wing with the entire surface, except the middle and upper marks, smeared with whitish scales, the basal area irregularly spotted with brown ; a very irregular, narrow, brown, outwardly curved band ending in a large, brown spot below the costa near apex, joined to a smaller brown spot on each side of it ; a discal band, mostly smeared with whitish, with an outward, even curve, edged on both sides by a brown, angulated line which is broad at the abdominal margin, gradually narrowing upwards ; a subterminal row of indistinct, small, brown spots capped with darker brown lunules ; all these markings often indistinct. *Cilia* of both wings black. Female.—Like the male above and below except that the inner area of both wings above is generally much duller in colour which is often more restricted. Antennæ black ; palpi black above and below with the head and body throughout concolorous with the wings. Expanse : 37 mm. to 45 mm.

Egg, larva, pupa.—Unknown.

Habits.—The insect is said to be nowhere common but as it occurs in such places as Calcutta, it has been entered in these papers. The habitat is Northern India, Siam, Hainan, China, Barrackpur, Mergius, Assam, Perak, Calcutta, Goalpara, Sibsagar, Chittagong hill tracts.

21. Genus—AMBLYPODIA.

De Nicéville describes the neuration of the forewing as being similar only to that of *Iraota* among the *Lycœnidæ* because of the conformation of the basal portion of and origin of vein 5 which he says is given off from vein 6 near the base of that vein, whence it is bent down, forming a false discocelular nervule, before turning off to the outer margin. Also vein 8 in the forewing is wanting in the female, present in the male. There are two species recognized of which only one, *anita*, concerns these papers. It is an extremely variable species in colour though never in shape; some of the males are brown without any purple shade on the upperside, others nearly uniform purple with, in both cases, a black border, also variable in width and even; the females are sometimes also uniform brown with a much broader black border or have a basal patch of, sometimes, quite briliant blue, most extensive on the upper wing. And these varieties may all be bred from the same batch of eggs. The undersides of the sexes are alike and resemble dead leaves in their shading and the presence of a "mid-rib" from the apex of fore wing to the anal angle of hind wing. *A. anita* is quick and strong of wing but never flies far; it rises, flies a short distance and then drops amongst the foliage; it is slow to rise and walks about when settled; it settles on leaves, stalks, twigs, &c., and keeps the wings closed over the back. The larva is somewhat abnormal and very brightly coloured; the pupa is stout and normal in shape. The habitat of the genus is throughout Continental and Peninsular India (except in the desert tracts, the Panjab and North Western Provinces); Assam; Burma; the Malay Peninsula; Java, Luzon; the Andaman Isles (but not in the Nicobars) and Ceylon.

166. Amblypodia anita.—Male. *Upperside*: dark violet-purple with very little gloss, the colour obscuring the marginal black border. Fore wing: no fringe of hairs on inner margin; costa and outer margin with a moderately broad, blackish band, generally broadest on the outer margin. Hind wing: the costal band broad, the outer, marginal band narrow, in most specimens a mere line: anal lobe marked with dull red. *Cilia* black; tail stout with a black fringe. *Underside:* rufous-brown. Fore wing with a subbasal, black, transverse line; a mark on the discocellulars a thin black line from before the apex to the hinder margin beyond the middle, followed by a postdiscal series of indistinct, disconnected, lunular, black marks or spots which are not always, however, visible; and sometimes, indications of a submarginal series; sometimes, also, the subapical, costal area powdered with black scales. Hind wing: medial, outwardly-curved, black line and an indistinct, outwardly-curved, discal series of black dots marked with white points, both in continuation of the two lines on the fore wing; a series of submarginal, similar, black dots and subbasal marks; the ground-colour of the wing varying in tone in different specimens.—Female *Upperside*: dull violet, sometimes quite brown. Fore wing with broad, costal and outer, marginal, blackish-brown borders. Hind wing: generally uniform dull violet-brown or brown without any borders; anal lobe as in the male. *Underside:* varying in shade from ochreous grey to violet-brown, the outer half lighter; markings as in the male but some of the darker coloured examples have a hand of suffused whitish marks in connection with the discal line. Antennæ black, the tip orange; head and body above and below concolourous with the wings. Expanse: 45 mm.

Egg.—Is of the ordinary, depressed, hemispherical *shape*, or very widely dome-shaped, broadest about half way up. *Surface* moderately shining; covered with hexagonal (sometimes pentagonal), very regular, large cells, about six from apex to base and about twenty-four round the broadest part; seven surrounding the apical micropyle irregularly smaller; the walls coarse, mostly triangular in cross-section, sometimes rounded: with an erect spine at each intersection or corner; the walls about as high as one-third of a cell-diameter, the spine as long as the walls are high; the concave bottoms of the cells minutely pitted. The largest cell-diameter is 0·075 mm; the walls are 0·05 mm. in width, the cells round the micropyle are at least 0·05 mm. broad; the micropyle funnel-shaped and 0·1mm. at the mouth. *Colour* is light-green in the cells, the walls are enamel-white, the spines translucent-white. B: 0·9 mm., over 1 mm. with the spines; H: 0·45 mm. without spines.

Larva (Pl. II, fig. 22).—The *shape* is somewhat abnormal and the horizontal section would be a very good representation of a rather short boot-sole, the heel being the posterior end of the body. The head is always hidden under segment 2; segment 2 is more or less semi-circular or rather trapeze-shaped, the narrowest side being the front margin, the margin is somewhat tumid and there is a dorsal, central, apparently triangular (really 4-sided) depression situated on a dorsal tumidity again, the bottom of the depression is glabrous with four or five minute tubercles, the thickened border dented on the front margin in the dorsal line forming a small triangular sinus; the body is broadest and highest at about segment 6, increasing from segment 2 backwards, after which it decreases in height and breadth gradually to the hinder margin of segment 8, increasing again in height and breadth, though in a lesser degree, in segments 9-11; the dorsal slope being more or less gradual from 6 to 11, 12 after which 13-14 have a much more steep slope: these two end segments are short and narrower by a good deal than segment 12; segments 8, 9 are generally narrowed into a kind of waist, 7 and 10 being broader—generally, because in certain positions which the larva assumes, this is not the case; in repose the hinder margins of all segments 3-10 is higher than the front margin of the succeeding segment; the ventrum is flat; all segments are well marked and the dorsoventral margin is transparent. The *head* is rather small, round, shining, yellow with a large triangular, white-outlined clypeus and black eye-patch and mandibles. The *surface* of the body is very shining and finely and distinctly pitted as also laterally corrugated; the free margins of segment 2 and segment 14 as well as the ventrum on the sides are all sparsely covered with minute, erect, stiff, dark hairs. There is a small, transverse gland on segment, and the organs on the segment 12 are small and cylindrical when protruded. *Spiracles* rather small, oval and more or less the same colour as the body. *Colour* of the body is oily green-yellow with a broad, electric-blue dorsal, lateral and subspiracular band, the whole length of larva from segment 2 to segment 12; segment 13 has only a dorsal smudge of blue. L: 17 mm. to 23 mm.; B: 7 mm.

Pupa (Pl. II. fig. 22*a*).—The *shape* is normal but very stout. The *head*-frons is perpendicular to the longitudinal axis of pupa; segment 2 has the dorsal slope in continuation of the front slope of the thorax; the thorax is somewhat flattened on the apex and the posterior slope is steep and short; the 4th segment is nearly as high as the thorax so that there is little hump about the latter; the dorsal line ascends gradually from segment 5 to segment 7 which is the highest part as well as the broadest of pupa; the slope from 7 to end is short and steep to the end which is rounded, segments 13, 14 being turned under; segment 2 is rounded in front, broadens out to its hinder margin from where the sides of the pupa are parallel as far as segment 5; after which the abdomen swells out again to segment 7. The *surface* of pupa is slightly rugose under the lens. The *spiracles* of segment 2 are linear, slightly raised, light; the rest are linear, light-coloured slits in the middle of a round, dark surface, each sunk in a shallow depression. *Colour* of pupa is brown of many shades dorsally with a darkish, dorsal longitudinal line and a black, circular spot at edge of wing (laterally) on segment 5; ventrum dirty greyish. L: 12·5 mm. and over; B: nearly 7·5 mm; H: 7 mm.

Habits—Many eggs are laid at a time irregularly on the uppersides of leaves on stalks, branches, buds; the young egg-larvæ living gregariously and continuing thus up to the last moult when they separate, each going its own way. The pupation takes place on the ground at the foot of the creeper as a rule in a crevice, under a dead leaf, &c., and there seems to be no body-band—only the tail fixing. The larvæ is never attended by ants, at least none have ever been noticed in their company. The growth of the caterpillar is rapid and the pupal stage only lasts seven days. The butterfly is strong-winged and of rapid flight but rarely seems to make use of its powers. It is sluggish when put up, flies only a short distance and settles again suddenly. It has the habit of walking about when settled on leaves, stalks, twigs and branches and always with the wings tightly closed over the back. It seldom, if ever, visits flowers, neither does it seem to feed on the juices of trees or suck water from the ground but apparently passes its life amongst the foliage of trees; and seems to prefer dense scrub-jungle in regions of heavy rainfall to anything else. The foodplant is *Olax wightiana* of the family *Olacineæ.* The habitat of *A. anita* is India, Ceylon, Burma and Siam. It is plentiful at sea-level on the coast of Kanara in Bombay and up to 1,800′ in the hills immediately above.

22. Genus—Arhopala.

As at present accepted, this genus contains about one hundred species. mostly Oriental from India, Ceylon, the Andamans, Burma, the Malay Peninsula, throughout the Malay Archipelago; some being also found in China, Japan and one or two in Australia. De Nicéville in his Butterflies of India, Burma and Ceylon, writes a short history of the genus in which he characterizes it as unwieldy, but says that there is no way as yet discovered of dividing it up, as the venation of the wings offers no basis. He states that the outline of the wing in different species varies much, in some there is a tail to the hindwing, in others none, and the colour of the uppersides is some shade of blue, more or less constant for each species, though differing in the sexes of the same butterfly sometimes, as, for example, the extreme case of a group, the type of which is *Arhopala eumolphus* from Sikkim, Nepal, Assam through Burma and Malay to Borneo, in which the males are metallic-green, the females blue. He further remarks: " An *Arhopala* is unmistakable, the merest tyro in oriental butterflies should at once be able to distinguish any species as belonging to the genus, which contains some of the largest as well as the most beautiful of the *Lycœnidœ.* Nearly all the species are of some shade of blue or purple on a black ground on the upperside, the females with the blue or purple colour always more restricted than in the male . . . Most fortunately the undersides of both sexes are alike, usually of some shade of grey or brown, with numerous darker spots and catenulated bands . . Secondly, sexual characters in the male are entirely absent . . . " He goes on to say that he has not noticed anything in the nature of seasonal variation in any species within Indian limits. All this is certainly true of the species found in Bombay, which are *centaurus* and *amantes, bazaloides, canaraica* and *abseus.* Of these only two are at all common, namely, *centaurus* and *amantes* which, with their transformations, are given below. *Hewitsoni,* which seems to occur sometimes in the Plains, has also been dealt with here. *Bazaloides* and *canaraica* are both found in the jungle-covered Ghats in Kanara District in Bombay, but are not common even there; it is the same with *abseus*, which is very rare. The butterflies of this genus are all strong fliers with robust bodies and ample wings, but none of them fly far at a time; they are insects of the forest and live amongst the trees, in foliage; like *Amblypodia* and *Iraota*, they fly very fast but are slow in getting up and settle suddenly on a leaf or twig or stalk in any position; walking slowly about at times and resting anywhere on leaf, stalk, twig or branch with the wings closed over the body; occasionally the males bask in the sun on the upperside of a leaf with the wings partially open and they have been seen sucking juices from wounds in tree trunks; they never, seemingly, visit flowers though they have (rarely) been noticed sucking moisture from the ground. The larvæ are abnormal in shape, being much flattened, they are all looked after by ants and are given to hiding in leaves, slightly rolled or bent into rough cells for the purpose, these cells fashioned with the help of silk emitted from the spinnerets; often the inside surface is also provided with a "bed" or silken carpet on which the caterpiller rests. The pupæ are abnormal in being rather long, from the fact that the anal segment is not turned under but is in a line with the rest of the body, and it is always widened out to resemble a horse's hoof; the tail fixing is strong, the body-band moderately tight and the pupa can move up and down rapidly from just in front of the end segment to produce a knocking noise when disturbed. The transformation from larva to pupa takes place, generally, in one of the larval cells; ants also guard the pupa. The foodplants are various and, at least in the case of *centaurus* and *amantes*, the choice of them seems to depend more upon the presence of the ant-protectors than upon the kind of tree as will be seen below.

167. Arhopala centaurus, Fabricius—(Pl. II, figs. 57♂, 57a♀).—"Male *Upperside:* both wings dark brilliant, violaceous-blue with very narrow, outer, black markings: *cilia* brownish. *Underside:* both wings ochraceous-brown. Fore wing with two looped spots margined pale bluish green in the cell and a subquadrate spot inwardly margined with pale bluish green and outwardly with greyish, at the end of the cell; a waved, postmedial fascia margined with greyish crossing the wing beyond the cell and the following spots margined with greyish:—one near the costa above the end of the cell and two beneath the cell divided by vein 2; the apical third of the wing is somewhat paler and contains a marginal and submarginal, dark fascia. Hind wing; with the following spots and fasciæ margined with greyish:—seven basal spots, a medial, transverse fascia connected above at vein 7 with an inner, broken, macular fascia extending to the inner margin of wing; a marginal and two submarginal, somewhat obscure fasciæ; three transverse, marginal, metallic greenish spots near the anal angle. Body and legs more or less concolourous with the wings.—Female. *Upperside:* both wings violaceous-blue. Fore wing with the costal and outer margins broadly fuscous. Hind wing; with the costal margin broadly, the outer margin narrowly, fuscous. *Underside:* both wings as in the male. Expanse: 50 to 52 mm."

De Nicéville gives the above description of true *centaurus*, Fabricius on the authority of Distant who says that he made certain by comparing the type in the Banksian collection in the British Museum. Distant says that Hewitson confused matters by depicting the wrong species as this. Then Felder described it as *nakula* in 1860. Fabricius named it originally as *Papilio centaurus* in the year 1775. Besides which Doubleday, in the year 1847, named it *pseudocentaurus*. Moore called it *pirithous* in 1881 and de Nicéville and Wood-Mason invented the variety *corruscans* in 1880. Swinhoe at the present time treats *centaurus, pirithous* and *coruscans* as good species, saying that the latter two can be easily distinguished from the first. From which it will be seen that a name is not always as simple a thing to fix as it looks. Swinhoe considers that typical *centaurus* does not occur in Bombay and considers that *corruscans* does.

Egg.—Similar to that of *Arhopala amantes.*

Larva.—The *shape* of this larva is abnormal in that it is much flattened and somewhat produced behind though not particularly narrowed; the dorsal line is gently convex from front to anal end, the transverse section being represented, say, by an arc subtending $\frac{3}{8}$ths of a semicircle or less; segment 2 is a slightly lengthened semicircle in shape and is slightly convex transversely, rising gently in the dorsal line from the front margin to segment 3, the posterior lateral angles slightly rounded and a little broader than the front margin of segment 3; the breadth increases gradually to the middle of the body, then decreases as gradually to anal end which is rather more narrowly rounded than segment 2; segment 3 is, therefore, slightly narrower than 2 at front margin and the body is there more or less parallel-sided; none of the segments are constricted at margins and the surface of the whole larva, is, therefore, quite even; the body is slightly flanged along the dorsoventral margin; segment 10 is slightly tumid along the posterior margin so that segment 11 is suddenly somewhat lower than it; the gland on segment 11 is situated near the posterior margin and is circular in shape and black in colour; the two mouths of the organs on segment 12 are circular, thinly black-edged and the organ itself, when protruded is short, cylindrical, white with the extremity spined or tubercled. The *surface* of the body is shining, oily-looking and set with numerous, minute, light coloured tubercles; round the front margin of segment 2 is a row of porrect, proportionately longish, reddish, simple hairs; there is also a fringe of similar hairs just under the dorsoventral margin all round, those in the centre of each segment somewhat longest; the spiracles are surrounded by a fringe, each, of similar hairs and there are a few at the bases of the pseudolegs; the top of segment 2 is smooth and shining. The *spiracles* are conspicuous, longly oval and dark red-brown in colour. The *colour* of the larva is green or deep greenish-red generally according as whether it feeds on green or red leaves; the following marking is invariable:—a broad brown, dorsal band from end to end, broadened out into an oval on segments 12-14 (all one oval mark, not one to each), this brown, on segments 2, 3, 4, covering the whole dorsum, bordered there by a narrow, green band, this marking gradually narrowing forwards up to posterior margin of segment 2, then broadening suddenly to narrow forwards into a broad line or narrow band finishing on the front margin; from the posterior margin of segment 4 to the anterior margin of segment 11 the broad, dorsal, brown band is flanked by a subdorsal, broader yellow one which is again flanked by a lateral, green, narrow band bordered below by a thin, yellow line; the green, narrow band as well as its lower, linear, yellow border running from end to end of the body; the broad, yellow, subdorsal band is marked from the middle of segment 7 backwards to the posterior margin of segment 9 with close, black, transverse, parallel lines; ventrum green. L: 37 mm.; B: 8 mm.; H: 6·5 mm.

Pupa.—*Head* rounded (frons), nearly completely hidden by segment 2, segment 2 semicircularly rounded in front, the hinder margin straight, transversely convex; thorax humped, very slightly carinated along dorsal line as well as segment 2, shoulders slightly prominent, lumpy, constriction at segments 4, 5 slight dorsally, none laterally; the pupa nearly parallel-sided from the shoulders to segment 7 but ever so slightly broadening so that the region at segment 7 is the broadest part of the body; the apex of the thorax is the highest; abdominal segments convex both ways, decreasing in width to segment 10, segment 11 being suddenly slightly narrower, breadth of 12-14 being the same breadth as segment 11; the body increases in height slightly from segment 5 to 7; the slope of segments 13, 14 rather steep; the anal segment is shaped like a horse's hoof, the suspensory hairs arranged beneath along the margin; the gland-scar dark-brown, circular, raised depressed in the middle; the organ-scars small hemispherical bosses also depressed in centre, light in colour; ventral surface much flattened. *Surface* very finely rugose, shining, covered with very minute, white tubercles. *Spiracles* of segment 2 linear with thin, slightly raised edges; the rest conspicuous, slightly raised, oval, light in colour. The *colour* of the pupa is very dark brown, smudged and speckled with blackish as a rule; but it may be more or less pure, light brown; wings generally lighter. L: 18·25 mm.; B: 7 mm.; H: 6·5 mm.

Habits.—The eggs are laid, always singly but often two or three on the same plant and often on adjacent leaves, on the upper surfaces of the leaves or on a stalk. From the time the larva emerges it is attended assiduously by red ants (*Œcophylla smaragdina*) which even stick to the pupa. The larva is very slow in its movements, lives nearly always on the underside of a leaf, lying along a vein or the midrib when small, when big making a loose house or cell for itself by drawing portions of a leaf together. It feeds exclusively on young leaves. The pupa often keeps to the cell thus made and is attached strongly by the tail and a body-band. It has the power of moving from the base of the "hoof" and, by knocking with its body against the leaf-surface rapidly, is capable of producing quite an audible noise. The butterfly appears about a month after the egg that produced it was laid. It generally emerges in the early morning but, in dull weather, rather later. It is an insect of powerful flight as might be assumed from the robust thorax. But it never flies far though its movements are excessively rapid; one sees just a glance of brilliant blue in the sunlight and it is gone. It is somewhat slow in getting up, unwilling, that is, to take to the wing; it pitches suddenly amongst the foliage a little further on and disappears. It walks about slowly on leaves, under and over, on stalks, twigs, &c. It occasionally basks in the hot sun with the wings partially opened exposing the extraordinarily brilliant upper surface which, in certain lights, positively scentillates with exuberance of colour. Ordinarily, when resting, the wings are kept closed over the back and the colour of the underside blends well with the surrounding lights and shades so as to make it difficult to spot a quiescent insect. The species is very plentiful on the immediate coast of Kanara in Bombay and the larvæ can be obtained in the monsoon months in large numbers if one knows where to look for them. It is a thoroughly jungle insect, found in places where the rainfall is heavy and, perhaps, there, preferring the dense, creeper-infested, damaged scrub with scattered high trees to the really good forest. It never goes to flowers but has been noticed sucking sap from a wounded tree-trunk and also sucking moisture from the ground. It is difficult to catch because of its very rapid, dodging flight and the nature of the places it frequents. It is rarely seen except amongst foliage. The plants upon which the larvæ have been found are *Terminalia tomentosa*, *paniculata* (*Combretaceæ*), *Lagerstrœmia microcarpa* (*Lythraceæ*), *Xylia dolabriformis* (*Leguminoseæ*). Its habitat is the Eastern Himalayas, Assam, Burma, the Malay Peninsula, Siam, Nias Island, Sumatra, Java, Borneo, the Andamans, Ceylon and Southern India. The figures 57 and 57*a* on Plate H are too red, the male too dull blue above and not blurred enough on the underside; the female (57*a*) has the colouring far too unequal on the upper and far too light on the underside.

It is best to append a description of the South Indian variety or species—if it, indeed, merits the name—christened *coruscans* by Wood-Mason and de Nicéville in 1880 from South India. As it is the South Indian species or variety, the description appended is based on whole rows of fresh insects and is taken direct from them without reference to the original one contained in the Journal of the Asiatic Society of Bengal, vol. xlix, pt. 2, p. 234, n. 54 (1880); which is, besides, not available for reference at the present moment.

167b. Arhopala coruscans, Wood-Mason & de Nicéville.—Male *Upperside:* purplish-blue, lighter and less intense in bright sunlight than the beautiful, shining morpho-blue of *amantes.* Fore wing: the black borders are here extremely narrow, not more than O. 5 mm. except at the extreme apex where the black broadens out slightly. There is a slight greenish tinge at the extreme base of the wing. There is a slight fringe of greyish hairs along the inner margin. Hind wing: the black border of the outer margin from vein 7 to vein 1 as narrow as on the fore wing; above vein 7 and below vein 1 is blackish-brown except at the extreme base where the blue invades the inter spaces; the actual inner margin, the body-groove is much lighter brown. There is no anal lobe and the tail at the end of vein 2 is short and broad (3 mm. or slightly more, by 1 mm.) and bluntly pointed; black with a small, greyish tip. There is also a very short production of the *cilia* at the ends of veins 1 and 3. *Underside:* fore wing: rufous-brown with the intervals between the terminal markings and the postmedial band as well as between that band and the medial-markings, rufous-grey, much lighter in colour; the rufous-brown, slightly darker markings exactly as in *amantes* band for band and spot for spot except that the spots in and at the end of cell are larger and bordered in their upper halves by very light bluish-green scales which stand out very conspicuously from the rufous back-ground; the postmedial band is also much evener than in the other species and there is never any streak in interspace 1 between the postmedial and medial markings: that interspace is here grey. Hind wing: brighter rufous-brown than on the fore wing, with all the markings of *amantes* visible as blurred spots and bands difficult to make out except that the double row of black, lunular, subterminal markings in the anal region are here replaced by brown ones and there is only a mere indication in interspace 1 of a sprinkling of light bluish-green scales where the spot should be; there is an indistinct wash of darker rufous-brown than the ground-colour from base through the cell to the terminal margin where it broadens out. *Cilia* of both wings above and below brown with the ends greyish—Female. *Upperside:* similar in colour to the male with the bases of wings more plentifully greenish. The broad black costal and outer margins similar to those in *amantes* except that, always, the posterior, terminal breadth is less than in that species; the veins all blackish (which is not the case in the male); the abdominal margin very light in colour. *Underside:* exactly as in the male. *Cilia* as in the male. In both sexes: antennæ brown, with a longly, graduated, rounded club which is tipped with orange and, in the male, sprinkled with white scales below; palpi brown, lighter below; frons and head brown; thorax above blue-green, below light brown; abdomen brown. Expanse: male, 50 mm.; female, 60mm.

168. Arhopaia amantes,—Hewitson. Male. *Upperside:* both wings brilliant morpho-blue, the base narrowly greenish with narrow black borders to the costa and outer margin; the veins blackish. Fore wing: the black border of costa narrowing from base to middle; the inner margin with a slight fringe of light-coloured hair. Hind wing: the costal, black border reaching from end of vein 6 to base, narrowing inwards; the outer margin narrow to vein 1; the anal margin inside vein 1 dusky black and longly haired; the small lobe rounded, with a rounded, shorter point of scales at end of vein 1, and shorter points at ends of 3-6; the *cilia* white between the two; a 5 mm. long tail at end of vein 2 which is 1 mm. broad in basal third, then narrower, black, tipped finally white. *Underside*: both wings grey, the spots and bands rufous-brown and darkest on their inner and outer edges which are, again, bordered thinly lighter or dull-whitish. Fore wing: the space in the cell, and between veins 1 and 2 occupying the upper half of that interspace in continuation, as far out as the inner edge of the postmedial band, slightly lighter rufous-brown than the spots and bands with the following spots superposed on it: a small spot in the base of the cell, a larger one in the middle, both round and one, more or less quadrate, decreasing upwards in small steps, enclosing the discocellular nervules; another at base of interspace 2, its outer edge in continuation of the inner edge of the discocellular mark; a very indistinct spot in interspace 1 up against the middle of the bottom of the cell and another, quadrate in the obtuse angle formed by the bottom of the cell and vein 2; the last two extremely indistinct and nearly merged in the ground-colour; the upper halves of the cell-spots are bordered with pure white, the bottom halves with soiled white scales. The rufous-brown streak between veins 1 and 2 outwards is sometimes irregular on the lower edge where the grey ground-colour of the wing sometimes runs up along the outer border of the spot in the obtuse angle below the base of vein 2; and, generally, there is a small production of the lower, extreme end of the brown streak downwards, very faint, into the lower half of the interspace. Beyond there is a more or less erect series of spots in interspaces 2-7 forming a postdiscal band, the lowest largest, quadrate or subtriangular, decreasing in size upwards, the third from the top moved slightly outwards: the inner and outer border dull-white except the inner border of the last two spots which is purer white; beyond again a subterminal straight, transverse, narrow line of the grey ground-colour leaving three series of indistinct quadrate spots of a darker (also rufous-brown but of a lighter shade) wash in the interspaces, the middle series lunulate and outwardly convex, the outer terminal and darkest and not reaching the costa: they all start at vein 1. *Cilia* brown with the outer half grey. Hind wing: a minute, basal spot on costa above vein 8; a transverse row of four round spots, one in each of the interspaces 7, the cell, 1 and 1a, the first and third largest, the last on the inner margin, all subbasal; two larger ones beyond: one in interspace 7, one in the middle of cell; a parallel-sided, medially slightly outwardly-bent lunule enclosing the discocellulars with a triangular spot in the base of interspace 2 and a larger one in 1 beyond in continuation inwards; a postmedial, transverse band, broken and moved outwards at vein 6, composed of a large, subquadrate mark consisting of two outwardly-convex, broad lunules in interspaces 6, 7 which mostly touches the discocellular mark inside and is continued by a pair of quadrate, much smaller, fainter marks in échelon outwards in interspaces 4, 5 followed by another pair in échelon inwards in interspaces 2, 3 which are themselves in échelon outwards; then a thinner outwardly convex lunule in 1 running in towards the inner margin and finishing up with a doubly-waved band running up to the inner margin at about the middle in interspaces 1a and 1b. These markings are followed by the same two indistinct, grey, subterminal lines of the ground-colour as on the fore wing, leaving the same three series of indistinct rufous-brown markings except that, here, in the anal region, the interval between these two grey lines is powdered with grey and the medial, brown lunules are replaced by thinner, black ones in interspaces 2 to 1a; on the anal lobe there is a large, deep black, round spot bordered inside with light bluish-green metallic scales and outside by white, with, beyond in interspaces 1b, 1, 2 a terminal dusting of mixed black and metallic bluish-green scales, bordered inwardly by thin, blackish or dark lunules. Antennæ with a very long, graduated club, brown above with a sprinkling of white scales below; head, frons and palpi brown above; thorax smooth with bluish-green scales; abdomen brown. Below palpi, thorax and abdomen light brownish.—Female. Like the male in the colour of the blue except that it is slightly lighter and the bases of the wings are more prominently greenish; and the veins blacker; the brown borders, however, much broader, fully 6 mm. on the outer margin; the black often running down from the costal margin along the discocellular nervules. *Underside:* exactly as in the male in every way, the colouring all round, perhaps, a bit lighter. Expanse: male, 55 mm.; female, 60 mm.

Swinhoe's description of the insect is as follows:—

"Male. *Upperside:* dark purple-blue, shining in certain lights, coloured somewhat line *pirithous*, but brighter blue; costal and outer, marginal line black. *Cilia* black, tails black: a rather long tail at the end of the vein 2, slight projections at the ends of all the other veins of the hind wing, more pronounced at the ends of veins 1 and 3 than at the ends of the others. *Underside:* grey, suffused with pinkish-brown; the lower portion of the fore wing pale, the hind wing darker than the fore wing, but varying much in shade; spots and bands chocolate-brown. Fore wing: with a small spot in the cell near base, a larger one in the middle, four conjoined spots at the end, the third from the upper end minute and sometimes absent; a discal band of conjoined spots from the costa to vein 2, increasing in size hindwards, the band slightly outwardly curved, sometimes very nearly straight down, but the middle spot always a little outside the others; all these spots and bands edged with bluish white; a subterminal, indistinct, brown band and still more indistinct, terminal band. Hind wing with four subbasal spots, three in a row, the fourth near the abdominal margin followed by two spots; an outwardly-curved bar at the end of the cell, with dark brown edges, with two spots in an inward curve below it; a discal, outwardly-curved, irregular band of spots and curves, commencing on the costa with a large, brown patch composed of two squarish spots joined together; a submarginal, lunular, thick, brown line and an anteciliary, thinner line, both more or less lunular, the latter edged outwardly with bluish-white near the anal angle where there is a black spot on the lobe capped with bluish-white; the bands with indications of very indistinct, similar bands between them; a black terminal line. Antennæ black; palpi black above, whitish-brown beneath; head, and body blackish-brown above, grey beneath. Female. *Upperside:* paler and brighter blue, merging into black on the outer parts; forming broad, costal and outer, marginal bands on the fore wing; with generally, a black spot at the upper end of the cell; hind wing with similar costal and marginal bands, narrowing much in the middle of the outer margin then broadening hindwards, with some blackish suffusion running up near the abdominal fold which is pale. *Underside:* as in the male. Expanse: 55-62mm".

Egg.—More or less hemispherical in shape, covered with 9 rows of pentagonal cells from apex to base, 24 rows round the broadest part; all these cells with coarse walls and a short spine at each intersection; there is one apical cell; the colour is green, spotted darker; the walls white. B: 1 mm.; H: O. 75 mm.

Larva. (Pl. II., fig. 23).—The *shape* is nearly the same as that of *Arhopala centaurus* but slightly stouter. *Head* light yellow, shining, round, hidden under segment 2. Segment 2 rounded in front, slightly thickened along margin, somewhat constricted behind, only very slightly transversely convex; 3 broader than 2, dorsoventral margin slightly flanged, dorsally higher than segment 2; 4 to 10 similar to 3, each one slightly higher at the hinder margin than the immediately succeeding segment; segment 10 is perhaps the highest part of the body: it is very tumid posteriorly where the large prominent gland is situated and is longer than any other segment; body broadest at 6, 7; anal segments flattened, very much so at the end, that end longly rounded. The *surface* is rather dull; the dorsoventral margin set with longish, erect hairs which are always most numerous at the anterior margins, practically wanting at the posterior margins; the front of segment 2 and anal segment are somewhat densely set with hairs round the margins; the spiracles, all except those of segment 12, are surrounded by red-erect hairs as well as the circular organ-orifices on segment 12. *Spiracles* situated on the anterior face of a slight tumidity on each segment. *Colour* of body is grass-green as the ground-colour; the dorsal region red-brown or chocolate, flanked by a lateral, thin, double, yellow line; a subspiracular, thin, yellow line; the posterior face of each spiracular tumidity is black except on segments 3, 4; segment 2 is bordered anteriorly with red-brown and has the large dorsal depression also red-brown with a dorsal, white line through it which is bordered by two dark brown bands; there is a darker, dorsal line from segment 5 to 11 bordered by a yellowish line, and it is broadened out on segment 10; on segments 12-14 is one pear-shaped red-brown mark, along the dorsal line, broadest behind; segments 12, 13 have a thin-brown band along dorsoventral margin bordered below by the thin, yellow line; ventrum green. L: 36 mm.; B: 8 mm.; H: 6 mm.

Pupa. (Pl. II., fig. 23a.)—Is exactly similar in *shape*, size and colour to that of *centaurus* except that the thorax is generally greenish and the abdomen red-brown. *Surface* sparsely covered with translucent-whitish, cylindrical, short hairs which are smaller than those of *centaurus.* The abdomen has a depressed appearance about segments 6 and 7.

Habits.—There is nothing to distinguish this species in habits from *A. centaurus* in any way. The red ants look after its larva just as assiduously; it frequents similar places, has the same habits of flight, &c., &c., and is rather more plentiful in Kanara; the foodplants of the larva are also identical. De Nicéville mentions that this species as well as *atrax* (under which name he includes *hewitsoni*, now recognized as a distinct species and to which de Nicéville refers) are butterflies of the Plains as well as the jungles; *amantes*, he says "is more widely spread than *centaurus*. It occurs............. in the plains of Bengal, the Central Provinces and Bombay and thence southwards to Travancore and Ceylon; in the last place it is found at 'Colombo'. He quotes Hutchison as saying that it conceals itself under leaves with its wings folded; and says that he himself took it in Calcutta under a big banyan tree in the Botanical Gardens.

169. Arhopala hewitsoni.—Male. *Upperside*: dull lilac colour. Fore wing: costal band blackish, narrow; outer marginal, blackish band rather broad, even in width. Hind wing: nearly all blackish-brown tinged with lilac, with lilac blue patch in the cell-space; filamentous tail of moderate length brown tipped with white. *Cilia* white, with a brown base. *Underside*: greyish-brown, markings a little darker than the ground-colour, with pale whitish edges. Fore wing with three spots, all sometimes more or less elongated, increasing in size outwards, near the base of the cell; an outwardly oblique spot below the last two cell spots, a spot somewhat elongated hindwards in the next lower interspace and a small, round spot above the middle of the two outer cell-spots; a slightly outwardly-curved, discal, even band of six conjoined spots followed by a disconnected spot; a marginal, pale brown line a submarginal band of rather thick, lunular marks and, between them, a band of paler marks; the lower portion of the wing pale in colour. Hind wing with the markings more indistinct; four subbasal spots, followed by three similar spots; a lunular mark at the end of the cell with two other lunular marks a little inwards, connected with its lower end; an irregular, discal band of eight spots, the first two from the costa and the seventh shifted a little inside the others, the eighth being a round spot a little more inwards on the abdominal margin; the terminal line and subterminal series as in the fore wing; anal lobe small, containing a black spot, capped narrowly with white and some whitish and metallic blue scales at the ends of the three lowest interspaces; indications of an anteciliary, whitish line on both wings, plainest on the hind wing. Female. *Upperside*: Fore wing with the lilac colour brighter; the costal blackish-brown border very broad; a black spot at the end of the cell merged in it, the outer margin broadly suffused with blackish-brown; leaving the discal, medial and submedial portions lilac-blue. Hind wing: uniformly brown, but often with a lilac tint. *Underside*: as in the male. Antennæ black; palpi black above, white beneath; head and body concolorous with the wings. Expanse of wings: 36 mm.

Larva, pupa.—Unknown.

Habits.—De Nicéville says: "*A. atrax* shares with *amantes*, Hewitson, the peculiarity of being a plains insect, with its headquarters in Orissa and Chota Nagpur, where at times it is said to swarm." Swinhœ says its habitat is "India, Burma. Recorded from Orissa, Chota Nagpur, Dehra Dun, Bholaghat in the Malda District, Sikkim, Jalpaiguri, Calcutta, lower slopes of the Nilgiris, Bernardmyo, Central Provinces, Chin Lushai and Chin Hills, Masoori, Shan States, Kumaon, Pachmarhi, Simla and Ranchi." He adds "it has hitherto passed as *A. atrax*, Hewitson in Indian collections. Hewitson describes two species as male and female, he figured the male only; this latter, a commoner form, Bethune-Baker has described as *Hewitsoni*; we have examples of both sexes, it is no doubt quite distinct from Hewitson's *atrax* of which there are examples of both sexes from Burma in the British Museum."

This ends the Subfamily *Arhopalinæ*.* It is characterized by the following:—legs normal (separating it from *Gerydinæ* which, however, do not concern these papers), fore wing with veins 5, 6 close to each other at the base dividing it off from *Lyceninæ*, *Theclinæ*, *Curetinæ* and *Liphyrinæ*), fore wing with vein 11, not anastomosed with vein 12 (differentiating it from *Poritiinæ* in which veins 11, 12 are anastomosed). This last differentiation, depending upon a vein-character which is not easy to see as all the costal veins are so close together, might cause trouble if the *Poritiinæ* were of any interest here: which they are not, as none occur in the Plains or in Bombay. None of them extend south of

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*Note:—On page 657, Vol. XXIV, Part 4 of this Journal B. N. H. S., the Subfamily *Arhopalinæ* should contain only the following genera:—

Thaduka, *Amblipodia*,
Mahathala, *Surendra*,
Iraota, *Arhopala*,

All the rest being *Theclinæ*:—

Zeizus, *Tajuria*, *Rathinda*, *Loxura*, *Bindahara*,
Creon, *Chliaria*, *Catapœcilma*, *Deudorix*, *Virachola*,
Pratapa, *Zeltus*, *Horaga*, *Cheritra*.

the Himalayas and most of them belong to Burma and the Malayan Subregion. The members of the subfamily are all, with the exception of the genera *Surendra* and *Zinaspa*, (not included here) large insects as the *Lycænidæ* go, have blue, purple or green uppersides, often brilliantly metallic and very characteristically marked undersides. Most of them have a lobe and tail , some have more tails than one , sometimes different in number in the sexes ; a few of the genus *Arhopala* have no tails and very little lobe—but, even then, the underside is always unmistakable.

23. Genus—Zezius.

This is another genus that contains but one species. De Nicéville writes : "In this genus the sexes are equally balanced, the male has an extra nervure (vein 8 wanting in the female), the female has an extra tail to the hind wing (at vein 3). It is strange that Mr. Moore should have overlooked the dissimilarity in the number of subcostal nervules (veins 7, 8, 9) to the fore wing which exists in the opposite sexes of the type species of this genus, though it was pointed out by Mr. Hewitson. The dissimilarity in the colouration of the sexes on the upperside is also remarkable, the male being brilliant coppery, the female dull blue and black. The genus contains but a single species which occurs in the Malda district of Bengal, several parts of the Bombay Presidency, in Ganjam, throughout South India and in Ceylon." The larva is abnormal in having segment 2 peculiarly formed, in having a short, tubular mouth to the gland and some fleshy teeth laterally on the posterior segments ; the pupa is similar to those of the genus *Arhopala* . The larva is attended always by red ants and, indeed, will not live healthy without them and is probably occasionally carnivorous, eating their pupæ.

170. Zezius chrysomallus, Hübner.—Male. *Upperside :* both wings coppery red, often with a strong violet gloss in certain lights, costal and outer margins narrowly brown, sometimes the brown diffused and slightly broader. Fore wing : no clothing of appressed hairs on the disc and no fringe of hair along the inner margin. Hind wing : with three black spots at the anal angle in interspaces 1b, 1 and 2, bordered by a marginal, slender, greyish-blue line ; a narrow tail from the end of vein 1 and another from the end of vein 2, both black with red and white borders. *Cilia* brown. *Underside :* both wings greyish buff-white, or browner. Fore wing : with two pale, reddish-brown or rusty spots in the cell another below the cell in the base of interspace 2 ; a paler, discocellular lunule ; a transverse, postmedial, cateulated band of eight round spots and a less distinct, submarginal, lunular line ; an anteciliary, fine, rusty line ; *cilia* brown. Hind wing : with two reddish-brown spots on the inner side of the costal nervure ; two within the cell ; two below the cell ; one on the abdominal margin ; a paler, discocellular lunule ; a broken, catenulated, discal band of eight marks, bent up at the lower end, those in interspaces 4, 5 slightly displaced outwards ; a submarginal, lunular line ; three marginal, anal black spots, the first and third with a red, inner border, the middle spot almost obliterated by blue-grey speckling. *Cilia :* brown with the bases grey ; the anteciliary line brown upwards, rusty in the middle, pure white in the anal third. Antennæ brown ; the club rounded, tipped orange ; body and palpi above : brown ; frons white and brown. Below : all white.—Female. *Upperside :* both wings violet-brown, the basal and discal, median areas, including the cell, pale blue ; an anteciliary, fine , black line ; *cilia* brown. Hind wing with an outer, marginal, slender, black line, margined internally in the anal region with white ; blackish, pale-bordered, submarginal spots in the posterior interspaces, the second and third darkest, the third bordered by a red lunule ; tails from veins 1, 2, 3 blackish with red and white borders, the middle one longest, the outer shortest ; *cilia* whitish with a broad, medial, darker line. *Underside :* both wings as in the male, the markings bolder. Palpi a little longer than in the male. In both sexes the legs are short, thickly scale on the tarsi and broad at the ends. The markings on the undersides of the wings are all light mouse-brown in the middle, bordered first rusty (sometimes diffused inwards), then dark-brown and, finally, white. Expanse : male, 32mm.; female, 40·48 mm.

Larva.—Head only partly hidden under segment 2, rather large, dull brown in colour. The general *shape* of the body is oblong, nearly quite parallel-sided, depressed, the dorsal line nearly straight ; the segments are well-marked because of the dorsoventral, central, fleshy, short, somewhat round topped, conical tooth ; segment 2 is large, square, transversely only slightly convex with four, accentuated, tooth-like productions on front margin, one subdorsal on each side porrect and pointing slightly upwards, one larger, lateral, pointing slightly out and up : segment 3 has the dorsoventral margin anteriorly provided with 2 similar teeth on each side,smaller than those on segment 2 ; each succeeding segment has one, central on the same margin ; segment 14 is semicircular in shape and has a dorsal similar tooth directed straight back from the margin ; the gland on segment 11 is situated near the hinder margin and is a truncated cone pointing up and back ; the organs on segment 12 are not visible. *Surface* more or less dull and covered with enamel-like, flattened, minute tubercles ; all the teeth of segments 2-14 are surmounted by a single hair, those of segments 2-4 stiff, longer, bristle-like ; segments 3, 4 have each one subdorsal, small, conical tubercle on each side of dorsal line, each surmounted by a hair ; segments 5-13 also have got these hair-surmounted tubercles ; at the base of each leg there is besides , a small, similar tubercle. *Spiracles* large, oval, flush, yellow. *Colour* of the body is green with a subspiracular, white line and a yellowish-white, lateral line formed of a series of crescent-shaped marks with the convexity upwards, one to each segment ; on segments 3, 4 the space between these lateral lines is brown as well as the upper faces of the teeth of segments 2, 3, 4 ; the hinder margin of segment 10 between these lateral lines also brown ; the gland-cone also brown, darker upwards. Sometimes the colour of the larva is very dark, nearly black-grey but all the markings are then still visible. L : 30 mm.; B : 6 mm.

Pupa.—Very like that of *Arhopala centaurus* in *shape* but the body has no loop fixing it, only the tail-fixing. The *head* is hidden from above ; segment 2 is of ordinary size, transversely convex, the dorsal line in the same plane as the front slope of the thorax ; thorax long, convex, slightly compressed laterally and, like segment 2, very slightly carinated in the dorsal line ; constriction behind thorax slight dorsally, none laterally ; the breadth is the same from shoulders to segments 6, narrowing thence to the front margin of segment 11 whence it broadens out again to the end which is horse-hoof shaped ; segment 13 only visible dorsally as a narrow strip ; the apex of the thorax is the highest point but only slightly higher than the body at segments 6, 7. *Surface* shining, very minutely roughened, quite naked, the gland-scar is a raised, circular mark near the hinder margin of segment 11. *Spiracles* of segment 2 are narrow, long, raised, transversely rounded, light in colour ; the rest of the spiracles are of ordinary size, flush, oval and brown. The *colour* is grass-green with an abdominal, dorsal, dark-green line ; the membrane between segments 9 and 10 is visible and brown in colour. L : 20 mm ; B : 6 mm.

Habits.—Eggs are never laid on any tree that has not got red ants (*Œcophylla smaragdina*) on it. The larva is constantly attended by these ants and is extremely restless, wandering about constantly from leaf to leaf and is extremely cannibal in its habits as it will eat any of its kind that may be changing its skin or pupating. One larva that was put among a lot of *œcophylla* which were brought in on some leaves was at once attacked by them so that ants evidently do not always like strange pets to which they are not accustomed. The pupation takes place on leaves, stalks, &c., and the head is always pointed upwards. The caterpillers make leaf cells or houses like those of the genus *Arhopala* and sometimes pupate in them. They grow slowly in captivity even when ants are kept with them. The butterfly is a bold, strong flier and very quick in its movements. The male may be found perched on the upperside of a leaf, about 10 to 15 feet from the ground, at any time in places that the species affects, with the wings half open basking in the sun. From this point of vantage he will dart at anything that goes by, pursue it for a space and then return to the identical leaf he left; often indeed he will take a fly without any apparent object. The males do not frequent the tops of hills and high trees however, keeping more to the sides of hills round open ground and the lower tree-growth. The females are rarely seen except when laying eggs. Neither of the sexes seem to go to flowers although they occasionally may be met with sucking moisture from damp places on the ground. The larvæ have been found on *Terminalia paniculata* (*Combretaceæ*), *Pterocarpus marsupium* (*Leguminoseæ*), *Dioscorea* (*Dioscoreæ*), &c.; but always and invariably only when there were red ants present. The habitat of the butterfly is Malda, Bombay, the Western Ghats, the Nilgiris, Ganjam, Ceylon. It *may* sometimes be found in the Plains but seems to be mostly confined to the hills and jungles where the rainfall is fairly heavy.

24 & 25. Genera—CREON and PRATAPA.

De Nicéville lumps these two genera under the name of *Camena*. He writes: "I have no hesitation in sinking the genus *Pratapa*, Moore, under *Camena*. As will be seen......the characters relied on to separate them are very slight, chiefly confined to the outline of the wings; the neuration is precisely the same as also are the male secondary sexual characters as I have ascertained by bleaching specimens of the type species of both genera."

None of the species of *Camena* can be said to be really common, though the males of *C. ctesia*, Hewitson, are met with in Sikkim in considerable numbers owing to their habit of coming down to the water-side to suck up water from the sand. All have a very swift flight and settle on the leaves of trees and bushes. *C. cleobis* in Calcutta is much attracted—as are almost all *Lycænidæ*—by the clear, honey-like fluid distilled by the flowers of *Poinsettia*; otherwise the butterfly is seldom seen. All the species are rich blue on the upperside in the male, with a more or less broad, black costal and outer margin to both wings. The underside is white, dull sordid white, or brown, always with a discal series of spots or a line, sometimes with the discocellular nervules defined by a dar line, always with two black spots crowned with orange towards the anal angle of the hindwing. The females on the upperside are also always blue, but of a paler, duller shade than in the males, often with a submarginal series of black spots between the veins on the hind wing. The hind wing has two rather slender tails of about equal length, one from vein 1, directed straight down, the other, from vein 2, pointing horizontally out; the body is robust, the head large, the eyes smooth, the antennæ moderately long and half ringed with white below. The larvæ are rather abnormal in shape, the pupa also, in that they have no body-band and have the last segment dilated and shaped like a horse's hoof; all the larvæ feed on *Loranthus* or *Viscum* of different species as far as is known—*argentea*, *deva* and *cleobis* have been bred and their transformations are known. The genus is known to occur in India, Burma and Ceylon but has not yet been recorded from the Malay Peninsula or further east.

170a. Camena argentea, Aurivillius.—Male. *Upperside:* both wings black with the disc overlaid with brilliant, hardly metallic, deep, azure blue. Fore wing: the blue occupies a short streak from base above the subcostal veins, the whole of the cell except the lower outer corner and a narrow edge, inside the discoidal nervules, the inner area from base below the cell as far as two-thirds the length of the wing including a streak between veins 2 and 3 and a small lobe at the middle of the inner margin. A few longish, grey, decumbent hairs on inner margin near base. Hind wing: the blue scaling occupies the whole of the disc below the cell including the lower, outer corner of the cell, from base to very near the outer margin, leaving an increasing breadth of black from vein 4 to vein 6; the anal area along the inner margin beyond vein 1 is brown and covered with a dense clothing of decumbent, rather long, grey hairs which encroach on the blue above at the base of the wing; half the black area from base outwards above the blue is shining (sexual mark) and clothed with differently formed scales from the rest. There is a thread-like tail at the end of vein 2 and another at the end of vein 1, both black, tipped with white, both about 8·5mm. in length, the former directed horizontally outwards, the latter straight in continuation of vein 1. There is also a small, rounded lobe on the inner margin just inside vein 1 which is slightly bent down and is black amongst the grey hairs, with a touch of the blue of the disc on its outer side. *Underside*: burnished silver like a new rupee. Fore wing: the area below the cell and vein 2 slightly fuscous, especially on the basal two-thirds of the wing where the scales are differently formed to the rest and there is a large tuft of dark-brown hair appressed against the surface, directed upwards from the edge of the lobe mentioned above to just above vein 1. There is a thin, light-brown, postdiscal line composed of outwardly slightly concave lunules between veins 1 and 7, sometimes with the ends indistinct. Hind wing: burnished silver with a similar, postdiscal, light-brown line from inner margin to vein 8, the lunule in the last interspace (the uppermost) displaced inwards as also that in interspace 1, though those in these lowest interspaces 1 and 1-a are very sagittate. The area outside this line in interspaces 2, 1, 1-a is whitish and there is a black spot in 1-a and 2, the latter crowned with yellow, the latter with a yellow streak along its inner upper margin. *Cilia* of both wings below: white with the bases brown becoming black towards the anal angle. Antennæ black, banded white below and with the tip longly orange; head black mixed with white, the eyes bordered white; palpi white, the upperside of terminal joint black; thorax and abdomen above, black; the former covered with blue-grey, decumbent hairs and some blue scaling, the latter with some blue scaling at sides; below white.—Female. *Upperside:* as in the male except that the blue of the upperside of the hind wing occupies the whole cell and above at base and is much paler, though still metallic. Indeed, in fresh specimens, there is sometimes difficulty in telling which is which without looking at the undersides. *Underside:* pure, smooth, light grey becoming, however, after some weeks, sullied by a slight pinkish or indian-red blush; the post-discal lines are plainer than in the male, the yellow crowns to the anal spots more diffuse and larger. Expanse: male, 32mm.; female, 35 mm.

This species has not been included in the key because it was at first thought that it was confined to the hills of the Kanara District. This is, however, not the case. It occurs all along the Western Ghats, (Kat, Mahableshwar, Matheran) and, probably, into the Thana District.

Egg.—Nearly hemispherical in shape, pitted with coarse depressions, some of them filled in with the white surface-covering which is spread, so to speak, all over the green shell—really an arrangement of cells with very thick, malformed walls; the micropyle apical, small, green, with thin netlines round it. Surface shining. Colour green, but spread all over so thickly with the white enamel-like cell-wall substance that little of the ground-colour is visible. Resembles very closely the egg of *Tajuria cippus*. B: 0·8 mm; H: 0·35 mm.

Larva.—The larva is of the normal *type* more or less but more parallel-sided. Generally: it is a grass-green larva with indistinct short, diagonal, lateral lines on the segments, has black spiracles and a large, conspicuous, enamel-white, somewhat brown-stained, four-cornered, transverse, dorsal mark on segment 2 with the angles in the dorsal line; the transverse, mouth-shaped gland on segment 11 red-brown with the centre white; segment 2 in no way covered by segment 3 but quite free: the head, however, as usual, hidden under segment 2. *Head* is of the ordinary size, hidden, round in shape, shining whitish in colour; with a large, triangular clypeus which is slightly brown-marked along lateral lower margins; smooth as to surface; eyes, jaws red-brown in colour. The *shape* of the body is onisciform (that of a *Polyommatus* or *Castalius*), the segments well marked, segment 2 swollen round the front margin, flat on dorsum behind the flange and in front of the hinder margin; third segment front margin rising from segment 2 evenly dorsally, continued in segment 4, &c., to about centre of larva; segments 5 to 10 being about the same height; the division between segments 11 and 12 very difficult to make out; the mouth in the dorsal centre of the piece consisting of these two segments, transverse, rather small though conspicuous because brown with a white centre; the anal flap and segment 13 somewhat extensive, a quarter ellipsoid, being convex, round-ended and inclined somewhat to be pointed; the prolegs are as usual, cylindrical, of usual development; the legs ditto. *Surface* of body is covered with minute, short, erect, blackbristly hairs, ordinarily hardly perceptible to the naked eye; all except the diamond-shaped surface, large and enamel-like white, bordered stained brown along edges, situated in the dorsal centre of segment 2; segment 2, when the larva is in repose with the head withdrawn under it, is very like the anal segment but without the thickened border or flange; the base of prolegs and the corresponding region of ventrum is covered with light, soft, erect hairs. *Spiracles* not very small, roundly oval, flush, black, rather conspicuous, those of segments 2 and 12 not any larger than the others. *Colour* rich darkish apple-green with indication of darker, dorsal, pulsating line and short, subdorsal and lateral, diagonal stripes on each segment; also indications of similar, lateral line and spiracular line. In certain positions the segments are better marked than in others and pits appear in centre of segments in dorsal line as well as lateral folds nearly parallel to the segment margins. L: 20mm; B: 6mm.

Pupa.—The pupa is attached by the tail, has a body band and the belly flattened to fit the surface of attachment closely; this is so far fairly normal, except for the flattening to slightly larger extent of the belly; the abdomen is shortened to a considerable extent and by so much the broader, being swollen out sideways like the abdomen of the pupa of *Curetis thetis;* there is however here more separation of the abdomen from the thoracic portion than in that pupa by constriction and the segments 1-5 as a whole piece are longer; the front of pupa is semi-circularly rounded, the side lines sloping away from each other, with a slightly concave curve to segment 7 at which they curve round strongly to meet in the dorsum of segment 11, this last and segments 12-14 being invisible when looking straight down on the pupa, forming the perpendicular (to the pupal longitudinal axis) end of the pupa ; segments 12, 13 very narrow, the anal segment also narrow and forming a broad curve closely applied to the attachment surface on a thin, silvery-silken pad ; segment 2 has its dorsal line at 60° to longitudinal axis, is moderately broad between straight margins, prominently convex between them also ; thorax starting at an ascent of 45°, curving round to come parallel with axis at hinder margin, which margin has its two lateral halves meeting in a point in dorsal line, each meeting the wingline in a widely open, rounded angle less than a right angle ; segment 4 is somewhat convex on its lateral surfaces and slopes down from thorax towards segment 5 which in its turn, very narrow, again slopes up towards segment 6 at a considerable angle ; segment 7 is the highest and broadest part of pupa ; the surface is depressed where the wing meets segments 3 and 4 and again at where it meets segments 4 and 5 ; from these points there is a transversely rounded depression, passing over dorsum on segment 5 in the latter case, another along each side of thorax forward and over dorsum just before middle of thorax in the former case (describing a curve forward that is) ; there is yet another wider and therefore less obvious depression or constriction between segments 2 and and 3. *Surface* of pupa shining covered all over, not very densely, with very minute short dark hairs (or tubercles) the brown diamond on thorax rugose ; also some lateral, brown spots on abdomen. *Spiracles* of segment 2 nearly linear, very light brown-green ; others, green, not very easily seen, narrowly oval, flush or nearly so, small. *Colour* of pupa light green, segment 2 suffused with grey, a band along depression or constriction over front of thorax also grey joining the margins of the wings which are also suffused in the same way ; the green slightly darker between these bands and along their edges ; a large, dorsal, light-brown mark, diamond-shaped, greatest length along dorsal line, from hinder margin of thorax to $\frac{1}{3}$rd of its length forwards, with a small subdorsal dot in front of it ; a triangle of three minute brown dots, apex posterior, in dorsal centre of each segment 6-10 (these are little pits really) ; a larger, lateral dot with a much larger, brown, raised ring just below it on the same segments—all these dots and rings of course small. L. 11 mm.; B at segment 7 : 5 mm ; at shoulders : 5mm.

Habits.—The eggs are laid, sometimes more than one or two on the same plant, in the axils of the buds, branches, &c., the young larvæ, emerging, eat the buds, later on the tender tips of the twigs ; finally twigs, even fairly tough ones ; the pupation takes place along a twig or elsewhere. The pupa with its swollen rounded abdomen, its narrowed fore part, and the constricted middle, centre of thorax, &c., resembles very strongly the face of a monkey, this resemblance being helped by the contrast between the grey bands and the darker green between ; the thoracic diamond is the nose, the lateral depressions on segments, 5-6 the eyes or the ‘ sunkenness ’ in the cheeks below the eyes ; the green band between the 2nd segment and the first grey band on thorax making an excellent mouth. The face is long with a huge bare forehead and sunken cheeks and long upper lip.

The egg-larva when it first emerged, is a dirty livid yellowish in colour with little dark bristles in rows lengthwise and others in between ; these, as is usual in most of the lycænid larvæ, disappear in the future stages. It eats into the little, tender twig-tops and generally prefers these all through its existence; only when full-grown will it eat the branches right down, even to where they begin to get tough. The foodplant withers and shrivels very rapidly except kept in a closed glass vessel. The young fruits are also attacked and the flowers. Ants rarely visit the caterpillars in any stage but occasionally there are some about and they *do* suck the gland. The pupa is formed, like that of *Tajuria cippus*, on the base of a stem or on a tree-trunk or elsewhere, with the head pointing down when on a perpendicular surface. It is attached by the tail but not extremely strongly and has also a body-band. When touched or otherwise alarmed it shivers imperceptibly but rapidly in the abdominal segments producing a somewhat high-pitched, knocking noise; but whether by actual impact against the resting-surface or otherwise is not substantiated. Altogether this larva and pupa seem to indicate that the butterfly, notwithstanding resemblances, should not belong to this genus *Camena*. It has the habits of *Pratapa deva* in that the male is fond of basking on the tops of high trees in the sun and it is even more prone to do this than that species. In fact the tops of hills and, there, the tops of trees, are about the only places where it may be commonly seen and caught. On a sunny day the male insects fly up to the tops of the hills and bask on the tip of a leaf near the top of a tree, sitting with the wings partially opened, the underside glinting like a new rupee in the sun so that, when seen at the proper angle, it at once attracts the attention and that even at a distance of as much as 30 or 40 feet! It rests for long intervals thus, then suddenly darts off after a passer-by, following for a considerable distance, sometimes up into the sky, at others in a wild chase over the tree tops and down the side of the hill; to return to exactly the same leaf, where it assumes its original pose. It may be found thus from about 11 a.m. to 2 in the afternoon in the monsoon months on the jungle-covered heights round Karwar on the coast in the Bombay Presidency. In the bright spells which alternate with driving mists from the open sea and, often, a heavy wind, there is, frequently, an absolute lull when the heat comes down, damp, oppressive and saturated with moisture like a heavy blanket, over the isolated hill-tops which rear their forest covered, boulder-strewn heads along the spurs of the Western Ghats in dead and mysterious silence. It is then that insect life really wakes up and revels in ecstasies of activity. Standing on a huge boulder only just below the tree-tops, may be observed the extraordinary phenomenon of hundreds of butterflies of all descriptions from the great *Papilio tamilana* with its glorious peacock-blue eye on the hind wing, with *P. daksha*, *P. polymnestor*, dashing along through a small clearing in the jungle to dive into the shades immediately below on their way down the hill-side; to the small *Terias hecabe*, *Leptosia xyphia* and *Bibasis sena* fluttering about the ground on the edges or darting backwards and forwards in a bewildering medley of colour. All the butterflies are males: half a dozen copper-coloured *Curetis thetis,* brilliant irridescent-blue *Hypolimnas bolina* and *misippus,* dozens of *Catopsilia,* a passing, darting streak of *Charaxes imna* or, perhaps, even *Charaxes schreiberi,* two or three *Charaxes athamas,* two or three golden *Cynthia saloma* males with an occasional green female; *Doleschallia polybete, Kallima wardi, Athyma, Neptis,* Skippers, Blues, &c., &c. It may sound exaggerated but it is not; it should be seen to be appreciated. A carpet of living colour! *Camena argentea* knows all about it, for it is in such places it was first caught and may always be found. The female is practically never seen and, until one was caught in Karwar on the hill-top where she had presumably, just come by chance, the sex was quite unknown. Afterwards another was also casually captured by a mere fluke, also on the hills. They were both looked upon as terrific prizes. That was in 1898 or a year or two previous to that. Great and continuous efforts were thereafter made to find the caterpillar and, until the year 1911, in vain. It was then discovered feeding on *Viscum angulatum* at Menshe in the Siddapur Taluka of the Kanara District in Bombay. This *Viscum* is a mistletoe, a parasite on, chiefly, *Olea dioica* belonging to the Ash family and a common tree in the evergreen jungles of the Western Ghats. It generally grows on rather sterile soil and is plentiful in the opener parts of the hills and uplands where the soil has been eroded and the rock exposed in the course of long periods of firing, hacking and cattle-grazing. The larva may also be found on *Viscum capitellatum* which grows much on such low shrubby plants as *Vitex negundo,* though also on large trees such as *Dalbergia latifolia,* the Blackwood, Rosewood or Shisam. *Viscum* is rather like the home mistletœ, especially in the whitish, wax-like, round fruit; *angulatum* is always leafless, hanging in great bunches of long, bare, thin twigs or branches from the host-tree. *Capitellatum* has much thicker stems and grows upright and also has thick, very obovate and rather heart-shaped leaves.

The following is a history of the stages of the larva:—

Egg laid on	26th January.
Larva emerged	1st February.
First moult	3rd midday.
Second moult, eat the skin .	6th about daybreak.
Third moult	9th at 8 a.m.
Fourth moult	11th at 8 p.m.
Changed to pupa	17th in the night.

The larva stopped eating on the 16th and settled down to change. The butterfly came out a week afterwards on the 24th. Thus it takes about a month from the laying of the egg to the mature insect.

The habitat of the species is Bhutan, Sikkim, Burma, Southern India; and de Nicéville gives also Ceylon.

171. Creon cleobis, Godart. Male.—*Upperside:* fore wing with the discoidal cell and the posterior base as far as the posterior angle brilliant, light sky-blue; the rest of the wing black-brown. Hind wing: brilliant, light sky-blue with black-brown *cilia*, tipped white between the tails; abdominal margin gray or cream-colour. *Underside:* both wings light creamy-brown with a well defined, narrow, undulating band of indian-red crossing the wings, terminating towards the abdominal margin in a zigzag manner on the hind wing; near the exterior margins is an obsolescent brown, transverse, subterminal line of lunules; near anal angle of hind wing two black spots, one on anal lobe in interspace 2, bordered interiorly with an orange lunule, outwardly the space powdered with white, interspace all powdered with white.—Female. *Upperside:* both wings differ from those of the male in their paler, duller blue coloration, that colour being more extensive on the fore wing. Hind wing: with the costa broadly black, with a series of marginal, black spots on outer margin. *Underside:* both wings as in the male, but lighter in shade. Antennæ black banded white; club rounded, tipped broadly orange. Palpi brown above, white elsewhere. Head with vertex grey, frons grey bordered, brown: eyes white rimmed. Thorax and abdomen are coloured with red above and below. The submarginal line is really double and filled in whitish, plainest on hind wing near anal angle. An anteciliary brown fine line bordered by a fine white one inside in interspaces 3, 2, 1, 15.

Cilia light brown, at anal angle mixed with white. Tail at 1 straight down 5½ mm., at 2 horizontal 3 mm., the one narrow, the other thread-like brown, tipped white Exp. 35.

Egg.—Nearly hemispherical covered with large, coarse-walled cells, three in a row from the apical, central pit to the base; the apical depression evenly concave and circular in shape and large, of the diameter of two of the cells; the walls of the cells without trace of thickening at their intersections. Surface shining though not much. Colour green which shows only at the bottoms of the cells. B: 0·8 mm., H: 0·4 mm.

Larva.—The *shape* is very similar to that of *Tajuria cippus* with the same prominence of the dorsal parts of segments at the margins, the same kind of "waist" at segment 8-10 but this waist rather more accentuated here because the segments 11, 12 are comparatively broader; the surface of the body is also similarly naked, shining-oily looking. *Head* rather small, shining, light in colour with dark mandibles, hidden under segment 2. Segment 2 with a tumid margin, more or less semi-circular in general outline with a deep, four-sided depression dorsally, this depression with a thin, white, dorsal line joining two angles; segment 3 is abruptly higher than segment 2 and overhangs its hinder margin with its anterior part or declivity, the dorsum being flattened and corrugated with a large, deep, transverse depression or dent; segment 4 is slightly higher again than segment 3 and is transversely convex dorsally and forms the highest part of the body; segments 5 and 6 are similar to segment 4 but descend posteriorly successively and are slightly flanged along the dorso-ventral margins; the body is broadest at these segments 5, 6; segments 7-10 are narrower and lower successively and have the hinder margin dorsally tumid and slightly overhanging each the front margin of the segment immediately succeeding so that, from a side-view, the dorsal outline looks dentate; segments 11 and 12 as one piece, broaden out laterally a lot and are much broader than segment 10 at their broadest part which is about their common margin. Segment 11 is dorsally as high as segment 10 and has a small, mouth-shaped gland, the organs on segment 12 not easily perceptible, circular and brownish-pink in colour; segment 14 is rather narrow and square at the extremity, overhanging the anal claspers a good deal. *Surface* of larva, as said above, shining, oily, naked except that it is thickly covered with glossy, circular, convex, minute shagreening and corrugated pits and depressions. *Spiracles* are oval, slightly raised, very light yellow in colour, and either yellow or black-rimmed, those of segments 11, 12 situated in depressions. The *colour* is rather difficult to describe:—that of segments 2-7, except the supraspiracular region of segment 7 and the dorsum of segment 3 (the former brownish red, the latter also and soiled dorsolaterally besides), is a greenish, soiled pinkish yellow with a dorsal, brownish band, two obsolescent, brownish lateral lines and a yellow margin; segments 8 and 9 are deep red-brown with a white, dorsal patch and dark-green dorsolaterally and laterally; segment 10 is rich, dark green dorsally with a subdorsal, whitish, diagonal line outside which the colour is brown-red; the remaining segments 11-14 are soiled, translucent-looking brownish or reddish with the margins of the swellings much lighter; the front margin of segment 2 is slightly greenish. L: 18mm.; B: 6mm.; H: 4· 5mm. at segment 4; the height being taken at segment 6-7 (which means the common margin of those segments).

Pupa.—Is also of the *type* of *Tajuria cippus. Head* not quite hidden by segment 2 and with two small, conical points, one on the front of each eye, close together and directed forwards; segment 2 transversely convex dorsally, semi-circular as to front margin outline, slightly emarginate on the dorsal line of front margin; thorax humped, transversely convex, with a very slightly depressed, dorsal line; shoulders rounded; the thorax is the same height as the body at segment 6; the lateral outline of pupa diverges from shoulders backwards to segment 6; transverse section of the abdomen is more or less circular, decreasing in diameter from 6 to 10; segments 11-14 forming the column or pedestal of varying length (in different individuals); this pedestal circular in transverse section, slightly widened out at the extremity in the manner of a horse's hoof where it is attached to the leaf, supporting the whole pupa from fore-end to segment 10 which portion is at right angles tò the pedestal or column; the ventral line from head to segment 9 (end of wings) being straight; the constriction behind thorax is dorsally slight, laterally nothing. *Surface* of the pupa is finely rugose with a pair of subdorsal, small tubercles on the apex of thorax; the hinder part of thorax and segments 4, 5 are roughened dorsally as also segments 6-9 with small, round-topped, shining tubercles. *Spiracles* of segment 2 are rather large, raised, oval, white; the rest being of ordinary size, oval, white. The *colour* of the pupa is:—head and wings as well as thorax green suffused with white; abdomen yellow-green with a broad, pinkish-brown dorsal band on segments 7-9, margined on the front margin of segment 8 and hinder margin of segment 9 with velvety-black; this velvety-black margining flanked by a subdorsal mark; segments 8 and 9 have a similar velvety-black mark on their common margin also. L: 15 mm. B: 5 mm.

Habits.—The larvæ have much the same habits as those of *Pratapa deva* in that, on emergence from the egg, they go for buds and young leaves, eating at first the undersides of the latter leaving the top cuticle only. Generally, a number of eggs are laid on one plant, all singly in the axils of leaves and flowers. The full-grown larva crawls about the plant anywhere and may generally be found sitting on a stem eating the flowers. It is slow-moving like all its kind and when disturbed makes itself quite hard and drops to the ground; but it must be disturbed violently to do this; a breath or shaking will not do; all the *Tajuria, Creon, Camena* and *Pratapa* larvæ do this. The pupation takes place on the upper surface of a leaf as a rule or on a stalk or stem with the head directed downwards; there is no body-loop. Ants do not pay much heed to the caterpillar or chryslis. The butterfly flies well but does not bask openly nor is it found at the tops of trees. It is an insect of the lower forest strata and is not often seen even where it is more or less abundant judging by the eggs and larvæ. The egg is much parasitized by small Chalcids and microichneumons though the larva itself seems to be fairly immune to parasitic attack. Ants do not trouble themselves much about the caterpillar and are rarely seen to visit it. The food-plants are *Loranthus elasticus*, the same as that of *Tajuria indra*—or *Viscum capitellatum*, one of the food-plants of *Camena argentea*. The former is a very common species of Mistletœ and is common on Mango trees and others. The habitat of *cleobis* is Continental and Peninsular India.

172. Pratapa deva., Moore. Male.—*Upperside :* fore wing with the discoidal cell and the posterior base brilliant blue intersected by the dark median and submedian nervures, costal margin and anterior half of wing before the posterior angle dark brown. Hind wing: with the middle, from the base, brilliant deep blue, a broad, costal and narrow, exterior margin of dark brown; along the exterior margin are disposed some blackish marks; a black spot on the anal lobe, surrounded with whitish; abdominal margin pale grey brown. Tails two, brown; *cilia* whitish. *Underside :* both wings very pale cream-colour with a series of interrupted marks disposed in an undulating line across the wings and terminating in a zig-zag manner abdominally on the hind wing. Hind wing: anal angle with a black spot bordered anteriorly with red and another of the same a short distance off on the exterior margin.—Female. *Upperside :* both wings paler blue, hardly metallic and with lighter brown margins. *Underside :* similar to that of the male.

Egg.—Hemispherical in shape, somewhat depressed. Surface covered with large, absolutely regular, hexagonal cells with thinnish walls; one apical cell the walls of which are buttressed inside; two and a half cells from apex to base—they are very large—but not including the apical cell; at each intersection of the cell-walls is a short, jagged-topped protuberance; the whole surface, as seen at the bottoms of the cells, pitted minutely. The egg is broadest at the base and white in colour. B: 1mm. or very near it, rather less if anything.

Larva.—The larva is more or less the *shape* of *Tajuria cippus* but there is no waist practically, also the tops of segments 3, 4 are not flat as in that species; body broadest at segment 5 and also highest; gradually narrowing and decreasing in height up to the end, the slope of anal segments slightly steeper than that of preceding segments; from segment 5 forwards the dorsal slope is also a straight line to the front of segment 2; body swelling out laterally in segments 4, 5, 6; segment 2 semi-circular in outline, deeply triangularly emarginate in the dorsal line of the front margin; the dorsal depression of segment 2 4-sided with a thin, dorsal line on it joining two angles, the bottom covered with minute hairs and coloured like the rest of the body; the anal segment is rather shortly square at the extremity and the same, black, subdorsal, impressed lines, that distinguish the larva of *Tajuria cippus*, running forward to the spiracle of segment 12. The *head* is hidden by segment 2, round, shining, light in colour. The transverse section of the body is triangular, more or less equilateral, more or less rounded at the angles, the body being more or less carinated along dorsal line and applied closely along ventrum to the resting surface; there is no dorso-ventral flange. *Surface*: dull, covered closely with minute, erect, pointed hairs proceeding each from a minute, cup-shaped base or tubercle, the edges of which are jagged or dentate; the dorsoventral margin with a fringe of fluffy, light erect, fine hairs. *Spiracles*: circular, rather conspicuous, dark brown-black in colour. The gland an oval, transverse depression on segment 11; organs on segment 12 hardly visible. *Colour* is the same as the colour of the leaves the larva feeds on: a kind of pale rose-madder green, velvety looking, a sort of brown-pink green sometimes; always with a yellow or reddish line running along the dorsal ridge and a yellow subspiracular line. The segments are not easily distinguishable except when the larva moves. L: 16 mm.; B: about 5 mm.

Pupa.—The *shape* is that of *Tajuria cippus*; it is longer, however, proportionately in the thorax than that species, being the same length from segment 5 to front as it is thence to anal extremity. The *head*-frons is more or less ventral; segment 2 rather flat dorsally, widely triangularly emarginate in the dorsal line of the front margin; the dorsal ascent the same as that of the front slope of thorax which is at about 45° to the surface of suspension; thorax humped, convex and very slightly carinated in the dorsal line with a small lump on the apex; the descent from apex of thorax to the lowest point of the constriction is very short and is at a very obtuse angle with the front slope of thorax; after the constriction the ascent to segment 6-7 is gradual; after which the descent over the abdomen is gradual to the anal end; anal segment widened out into a horse-hoof-shaped dilatation, the widening commencing at segment 12; the sides of the flat-topped segment 2 widen out gradually to the shoulders; whence again, the breadth increases to segment 7 which is by a good deal the broadest part of the body; after that the breadth gradually decreases to the end; the apex of thorax and body at segment 6-7 are about of equal height; from the posterior margin of segment 6 to anal end the dorsal region of abdomen is somewhat flattened, the sides nearly perpendicular to it without there being an angle anywhere between them however; the ventral part rather convex transversely; ventral line from head to segment 9-10 is straight, that from 9-10 to end also but these two portions are inclined to each other at an obtuse angle so that the head touches the surface of attachment although the rest of the pupal ventral line is free from it except the tail. *Surface* of pupa shining, glassy, absolutely naked; segments 6-7 having a central ridge each which is transverse to the pupal length, these ridges curved with the convexity backwards; one round, dorsal, small tubercle centrally on segments 2-13. *Colour* white, greenish-brown on the flat dorsal aspect of segment 2, a broad spiracular band on abdomen oily-brown as well as the dorsal part of segment 6; wings white with a brown, longitudinal streak down each; ventrum white. L: 14mm.; B: 6mm.

Habits.—The eggs of *deva* are laid in the axils of leaves and flowers like those of other related species. The little larvæ eat in the same way also: at first, when very small, in little, more or less round patches from the undersides of the leaves, leaving always the top cuticle intact; the little caterpillar lies in this hole as often as not; otherwise in the axils of the veins, at the base of a flower-tube, amongst the buds, &c. When full grown it lives anywhere about the plant. Up to the time, however, that it is full grown it continues to live underneath the leaves and to eat in the same way except that the holes soon become passages and the passages become longer and broader with the increase in size. When full grown also it may still continue to lie on the underside—in fact generally does—eating the whole leaf from the edge: in doing which it hardly ever protrudes the head from under segment 2 but clasps the edge with segment 2 so to speak, the margin of which therefore can assume any shape desirable. It is very difficult to see as the colour is exactly that of the leaves and flower-bud of the plant. The pupa is generally on the upperside of a leaf of the plant itself or of some other shrub or plant that may be in the vicinity. The larva wanders a good deal in its slow, deliberate way before changing. The pupa is fixed only by the tail and is capable of shivering vertically up and down from the segment-margin 9-10; so as to produce, on alarm, a rapid knocking noise. The butterfly is not often seen but is the commonest of the *Camena-Creon-Pratapa-Tajuria* group in Bombay always, of course excepting *Tajuria cippus*. It inhabits, in Kanara, similar places to *Camena argentea,* i.e., the tops of hills and small plateaux on their slopes where its food-plant is plentiful. The particular *Loranthusscurrula* is as common at a height of a couple of hundred feet from sea-level in Kanara on such trees as *Terminalia paniculata* as it is higher up and, as was only to be expected, the larvæ were found there on it also. So the female at any rate must live down there also although she practically never is seen except when ovipositing (laying eggs). The male seems to like the tops of high trees and may be seen any day in the monsoon months basking on the leaves of such in company with *Camena argentea* which it resembles in its habits of sitting and flight. The female is not *rarer* than the male ; on the contrary, she is more plentiful, as is proved in breeding by the fact that the majority of pupæ produce that sex. *Pratapa deva* is found in India, Burma and Ceylon. The caterpiller does not attract ants.

26. Genus TAJURIA.

"Differs from *Pratapa*, Moore (=*Camena*, Hewitson), in the absence in the male of both the tuft of hair on the forewing and the glandular path on the hind wing. Fore wing: broader and more regularly triangular in form; venation similar. Hind wing: comparatively narrower and more produced hindwards; discoidal cell broader, the subcostal and median nervules emitted further from the base." (*Moore.*) . . . in my opinion the sexual characters which are present in males of *Pratapa* (=*Camena*) and wanting in those of *Tajuria* are very important structural characters, and had they been wanting in *Camena* I should certainly and without hesitation have run the two genera into one (*de Niceville*). This is so; they are all very like species of *Camena*, the males are mostly bright metallic blue on the upper sides, the females generally light, non-metallic blue; the undersides are also more or less similar: some pure white, grey or brown with very well-defined lines or spots of brown or black. They are all strong, good fliers, frequenting trees and vegetation. The larvæ of *indra cippus* and the nearly allied (*Ops*) *melastigma* all feed on species of *Loranthus* and the pupæ are without body-band standing free on their tails.

173. Tajuria indra, Moore. Male.—*Upperside:* both wings brilliant morpho blue, the margins black. Fore wing: the costal margin very narrowly black. Hind wing: with two tails, the lobe and two caudal spots black, bordered below with white. *Underside:* both wings white, the outer margins broadly brown suffused with grey and crossed by a white band. Hind wing with three black spots, one V-like, above the anal angle; the lobe and caudal spot black, the former crowned with silvery-blue, the latter with orange; a black spot between them irrorated with silver, the outer margin black, bordered inwardly with white. *Cilia* white. (*Hewitson*). Female. *Upperside:* both wings pure brown. Fore wing: immaculate. Hind wing: with a broad, oblong, posterior band of a pale azure tint, varying according to the aspect to pale sea-green with a silvery reflection and bearing, at the exterior edge, three oblong, black marks of which the interior is deepest black, the whole bordered externally by a white, marginal line separated from the black *cilia* by an intermediate, black thread which is flexuose in the anal region; the anal lobe bears a lunule covered with sea-green, resplendent dots. *Underside:* both wings with the basal portion satin-white, the exterior half brown with a slight violet shade; the latter further subdivided, in the fore wing, by an intermediate, abbreviated, undulated, white striga, the posterior half being pale and the whole of the inner (tornal) angle grey. Hind wing: the costal area is white marked with four obsolescent, grey spots which get fainter as they recede from the apical angle; the anal region is white and bears two very large, strongly pronounced, intensely black, circular, ocellate spots with an intermediate, round group of greenish-silvery irrorations; the exterior oeillus bears internally a broad, orange lunule spreading in a radiant manner towards the disc; the second ocellus occupies the lobe and is entirely surrounded by a narrow, annular iris of pale green-silvery; parallel to the line of the ocelli, above them, three delicate, black marks are arranged in a series, the intermediate one forming an angular mark like the letter V, the latter ones two short, oblique striolæ; a very faint, oblique, bifid streak stretched from the inner ocellus towards the anal angle. Body brown above, white beneath. Antennæ brown with a ferruginous tip, marked underneath with alternate white and brown bands. Tails white, very delicately fringed at the sides and with a distinct, black, medial line. (*Horsfield*).

Larva.—Is similar to the larva of *T. cippus* in general *shape* except that there is hardly any "waist" and that the colour is altogether different. The body is nearly the same breadth throughout (except at segments 2 and 14); the dorsal "teeth" are only slightly developed, the height at segment 4 is less pronounced than in *cippus*. The *head* is black and shining; the depressed dorsal, 4-sided space on segment 2 is dull-black; the anal segment is sharply square behind and has an impressed, subdorsal, black mark; the gland is situated on the top of a tumidity on segment 11. The *surface* is shining and pitted and corrugated and covered with very minute bright orange-coloured tubercules. The *spiracles* are round, bright yellowish, situated in depressions. *Colour* is dark chocolate; the dorsal, flat surface on segment 3, 4 is shining reddish; there is an obsolescent, dorsal, red line the whole length of the body; ventrum is rosy white. L. 19 mm.; B: 6 mm.; H: 5 mm. and a little over.

Pupa.—*Shape* is also more or less like that of *T. cippus* but is smoother and of a different colour. *Head* hidden under segment 2, the frons inclined ventrally; segment 2 semicircular as to front margin, broadly and shallowly emarginate (cut out) dorsally on that margin, laterally concave on the dorsum, rather highly convex longitudinally; thorax only slightly humped, evenly gently rounded, the front ascent being in the same plane as that of segment 2, about an angle of 70° with the longitudinal axis, apex posterior to the line joining the shoulders, this apex the same height as pupa at segment 6; shoulders a good deal broader than the hinder margin of segment 2, evenly rounded and of slightly less width than the body is at segment 7 which is the broadest part; the constriction at segments 4, 5 slight dorsally as well as laterally; abdomen convex transversely and swollen out laterally, the last 5 segments 10-14 forming the pedestal or stalk so to speak, which supports the body; the last segment broadened out into the shape of a horse's hoof with the suspensory surface ventral all round; ventral line from head to end of wings at posterior margin of segment 8 is straight, the distance from segment 9 to anal end being short and at an angle to it; the distance from front to end of thorax is nearly half the whole length of the pupa measured in a straight line. *Surface* of pupa transversely striate-roughened with two subdorsal, small tubercles on each side on thorax, a slight, roughness on each shoulders, a central, dorsal collection of small tubercles, ten in number on segments 6-9 and a spiracular collection round each spiracle of 2 or 3 on the same segment; there are no hairs. *Spiracles* of segment 2 oval, raised, facing forwards, light in colour, rest large, oval, light, those of segments 10, 11 being in rather deep depressions. *Colour* of pupa is rather light yellow-brown suffused dorsally with white as well as along the edges of wings; a black patch round the spiracle of segment 2 and another, lateral, on each of the segments 9-14; another, lateral, on segment 5; the white marking and black patches, when the pupa is looked at from above, resemble an old man's face, or a monkey's, the abdomen being the fore head, the white dorsal thoracic marking the nose, the black marks on segment 5, the eyes and the rounded front margin of segment 2, the mouth. L: 15 mm.; B: 6. 5 mm.; H: 6. 5 mm.

Habits.—The habits are much the same as those of other members of the genus or those of the different species of *Camena.* The eggs are laid, always singly, but often many on the same plant, in the axils of flowers, on the flowers, their stalks and other places. The young larvæ often eat into flower-buds but also live on the young shoots of leaves. When full-grown they live anywhere on the plant, among the flowers and on the branches, leaves, &c. The butterfly chooses plants near the ground as a rule to lay her eggs on and always selects shady spots in the jungle. It is an insect of the forest and hills where there is heavy rainfall and is never found in the Plains. It is fairly plentiful on the coast in Kanara in Bombay where it was originally bred in the height of the monsoon. It flies well and does not like the sun; it therefore keeps to shady places, is not often seen except round the food-plants and never goes to flowers or, as far as is known, to water. It rests with the wings closed as a rule and rarely basks with the wings slightly opened. It never flies far at a time and has the habit of walking slowly about when sitting. The pupa is formed along a stem with the head pointing downwards and is attached only by the tail, there being no vestige of a body-string. Ants of the genus *Cremastogaster* attend the caterpillers. Larvæ have always been found on the same species of *Loranthus*, namely, *elasticus* which is very plentiful on Mango trees and Pipal, a species with smooth, hard, oval leaves often spotted with reddish and flowers with no stalks in circles round the branches. The insect is found in Sikkim, Assam, Bengal and Southern India: Kanara, Travancore and the Nilgiris; the Malay Peninsula; Nias Island; Sumatra; Borneo and Java.

174- Tajuria cippus, Aurivilllius.—Male (Pl. H., fig, 53).—*Upperside*: both wings brilliant cyaneous-blue, the costal border of fore wing and outer margin of both wings deep, glossy black, broadening out on the fore wing to include the whole outer, apical portion outside a line starting at the middle of the costa and ending at the tornal angle; the abdominal fold of hind wing grey; *cilia* grey; thin tails from veins 1 and 2 of hind wing, the former the broader and shorter, about 4mm. in length, black with white edges and tips. *Underside:* both wings satiny grey with a postmedial, thin, black line across both wings, composed of small lunules between the veins, six on the fore wing, seven on the hind wing. Fore wing: this postmedial series of black lunules beginning further from the apex, ending nearer the tornal angle, nearly straight; followed by a submarginal series of greyish, oblong spots faintly margined with white. Hind wing; the postmedial series further from the outer margin than on the fore wing, more irregular in that the second pair of lunules are displaced slightly outwards, the seventh being V-shaped with the convexity outwards and rounded at the apex; this lunule series continued to near the anal margin by a straight, black bar of similar width, displaced slightly outwards, starting from vein 1 and running slightly upwards; outside this a more distinct series of submarginal, oblong, greyish spots than on the fore wing, interrupted in interspace between veins 2 and 3 by a circular, jet-black spot on an orange patch which occupies the breadth of the interspace and is straight-bordered inwardly; followed by another, rather larger, jet-black, transversely broadly oval spot occupying the anal lobe and bordered inside by an orange lunule and with a narrow, metallic streak on it externally; the space between these two spots is a group of silvery specks on a hoary ground; there is also, besides, a faint marginal series of oblong, greyish spots on both wings. Antennæ abruptly terminated by a short point, brown with a ferruginous tip and marked on one side with transverse, greyish dots: body greenish blue above, with delicate, white hairs beneath.—Female (Pl. H., fig. 53*a*). *Upperside:* both wings sordid white with pale azure-silvery scales at the bases of both wings. Fore wing: with broader, black-brown borders than in the male, but similar. Hind wing: the costal margin broadly pale brown; a postmedial series of 5 black lunules in interspaces from vein 2 to vein 6; a subterminal similar series with the two at the anal end larger, rounder, more prominent and preceded by an obsolescent brown lunule on the lobe. *Underside:* both wings as in the male but the marking bolder. Expanse: male, 30mm. to 45mm; female, 37 mm. to 45 mm.

Egg.—Hemispherical in shape, minutely rugose, white; under a lens the roughness is seen to be due to many smooth, tubercle-like prominences. B. O. 7 mm.

Larva.—(Pl. II., fig. 26).—The *shape* is abnormal in that the larva is nearly as broad at segment 10 as it is at segment 5 which is the broadest part; it has a "waist" that is, being narrowed between segments 5 and 10. The *head* is hidden under segment 2, is dark brownish-yellow in colour, round in shape, and shining. Segment 2 is, generally speaking, semicircular in shape with a short, rounded, tumidity or lobe subdorsally and laterally on the front margin, 4 in all round the free edge and it has an hexagonal dorsal depression in the centre with a shining bottom, this depression being nearly as long as the segment and half its breadth (transversely to length of larva), the depression having a light, dorsal line on it; the segment ascends gently to the hinder margin; segments 3, 4, 5 rise up in steps so to speak from 2 forming with segment 6 which is not so high as 5 a hood-shaped piece; dorsally the body slopes down to segment 10, rising into a kind of knob and thence, over 12-14 descending in a curve to the anal extremity; laterally, the outline of the body is: broadening out in a curve to segment 5, then bending round this broadest part to narrow again in a curve to before segment 10, then widening out again rapidly to narrow more suddenly still to the rather narrow, short, trapeze-shaped anal segment, the lateral margins of the trapeze being shortest, the posterior margin, the extremity of body that is, somewhat longer, the anterior margin longest; segments 3, 4 are dorsally flattened forming a sloping, yellow and brown, six-sided surface bordered on segment 4 posteriorly by a low transverse carination; each segment 6-10 is higher at the posterior margin on the dorsum than the succeeding segment at the front margin; the gland on segment 11 is present; the organs on segment 12 are also present. The *surface* is shining, rather oily-looking and is more or less irregularly corrugated and pitted all over; it is quite naked. The *spiracles* are round, rather prominent and brown in colour. The *colour* of the larva is ashy grey with the following markings: segments 2 to 5 nearly totally suffused with dark-grey: segments 6-10 dark on dorsal area, each with a short, curved, subdorsal, black line, dorsum of segment 10 and 11 very dark; laterally a semicircular patch of dark-grey reaching from the dorsoventral margin half way up the body stretching from the anterior margin of segment 8 to the posterior margin of 10; a black spot at posterior margin of segment 12, two small, impressed, subdorsal, black lines on segment 14; segments 6-10 each with a yellow, dorsal spot on the hinder margin; ventrum pallid. Sometimes the dark-grey is replaced by dark red. L.: 18 mm.; B: 6 mm. at broadest part.

Pupa.—(Pl. II., fig. 26*a*.) Abnormal in *shape*, like that of *T. indra*, with a considerable, rounded constriction behind thorax and a "stalk" composed of segments 12-14, the last (anal segment) spread out in the shape of a rather high horse's hoof (this is, however, variable with the circumstances of attachment). *Head* hidden under segment 2, inclined towards ventrum; segment 2 rather long, with a rather deep emargination in the dorsal region of the front margin, the dorsal ascent is steep and in the same plane as that of the anterior slope of thorax, the thorax very much humped with an anteriorly-curved, transverse ridge over the vertex from which the descent to the 5th segment is rapid: segment 5, 6 again ascend in dorsal line to the middle of the latter segment whence the descent to anal extremity begins gradually at first, then more rapidly; the pupa is highest and broadest at segments, 6, 7 but nor very much broader than it is at the shoulders, the portion between these points being narrower gradually; the ventral line is straight from head to segment 8 then bent abruptly at an obtuse angle and is straight again to end, this angle of bend depending much on the length of the "stalk" which is very variable; the dorsal slope of segments 11-14 is generally straight and about 40° to the surface of attachment. *Surface* of larva moderately shining with the following transverse ridges, &c.:—the one above mentioned on the thorax; one, central across segment 6 made up of the lateral halves, each curved concavely backwards the ends of the curves meeting on the dorsal line; similar bisinuate ridge on segment 7; segment 8 again similar but the ridge less pronounced; the whole pupa covered with minute spots, the thorax somewhat lumpy on the surface. *Spiracles* of the segment 2 raised, longly oval, yellow with the surface much pitted. *Colour* of the pupa is brownish-grey beautifully marked with light-green, the sides of the abdomen bright green; the highest points with light brown and the depressions with velvety black. L: 15 mm.; B: 6 mm.

Habits.—De Nicéville quotes "*T. longinus* is not only the commonest and widest-spread species in the genus, but it is also one of the most beautiful, the blue coloration of the upperside in the male being exquisite. In Calcutta I have found it abundant on the flowers of *Poinsettia* during the winter." *Longinus* is the old name for *cippus*. It does not often come to flowers, neither does it drink from moist sand or earth. It is generally found about foliage and then always foliage of trees, rarely low down; it occasionally may be seen basking with its wings partly opened (only the male) but even that not often.

It flies well and strongly and never straight, but eratically, dodging about and settling frequently amongst the leaves of trees ; it is hardly ever found at the tops of trees with the males of *Camena deva* and *Camena cippus*, probably because it does not ordinarily bask in the sun. The female is generally found near the food-plant and is not seen as often as the male. Neither of them is, however, rare and can always be had wherever *Loranthus longiflorus*, which is the common food of the larva is to be found ; and that means over the whole of India except in the absolute deserts. The eggs are laid singly on the young shoots or flowers. The young larva lives on the flower-buds or young leaves and the full-grown larva generally anywhere on the plant, on the under or upper surface, of leaves or on the stalks, branches, &c. It is hardly ever attended by ants though some occasionally visit it. The pupa is found attached to the upper surface of a leaf, or to a stalk or branch and generally with the head pointing down ; it is fastened only by the tail and lies quite free with the head,however, generally touching the surface to which it is fixed. The insect is found throughout India except in desert tracts, in the outer Himalayas ; Ceylon ; Burma ; Malay Peninsula ; Java.

The male and female are pictured on Plate H, figures 53 and 53*a*. The pictures are good except that the undersides are too pink as is also the upperside of the female wings on the paler parts.

175. **Tajuria jehana,** Moore. Male.—Allied to *Tajuria cippus*, Aur., but of smaller expanse. Male and female. *Upperside :* both wings with the posterior areas slatey-blue. Hind wing : with three black, marginal spots from the anal lobe. *Underside :* both wings greyish creamy-white. Fore wing : with an indistinct, black, submarginal line. Hind wing : with the submarginal line more distinct and zigzag, a prominent anal and subanal, black spot, each surmounted inwardly by a yellow lunule, the intermediate space between the spots black-speckled. Female. *Upperside :* Hind wing : with a zigzag, submarginal band. (Moore).

The above is quoted from de Nicéville's book. He remarks : "This is doubtless a perfectly good and distinct species, though it may be a little difficult to recognise, as both the sexes in colouration resemble very closely the female of *T. cippus*, Aur. The male *T. cippus* is of course abundantly distinct from both sexes of *jehana*. Some males in my possession show traces of the submarginal, brownish, zigzag band on the upperside of the hind wing, but their sex may be determined by the narrowness and acuteness of the apex of the fore wing."

The description above given fits a male and female caught in Kanara except that the male is as bright, metallic blue on the upperside as any specimen of *Tajuria cippus*. It is much smaller however as is the female than the corresponding species of *cippus*. This female altogether wants the submarginal, brown line of lunules on the upperside of the hind wing although the male has them. In the male this line, on the underside, is black instead of brown as it is in both sexes of *cippus*. The dots representing it on the upperside of the male are also black. The underside of both sexes are creamy-white with a suggestion of pinkish, whereas, in *cippus* it is much purer light grey. The two anal spots are present and prominent in both sexes ; the lobe is exactly as in *cippus*. Apparently the portion of the submarginal line on the underside between veins 2 and 3 (in interspace 2) is always lunulate outwards in this latter species whereas it is straight in *jehana*. Head black, the frons broadly white at sides and the vertex also white; eyes bordered white; antennæ, orange, palpi and abdomen black above, the first speckled with white, the abdomen with bluish hairs at base and on thorax; beneath all pure white. Expanse: male, 29 mm; female, 34 mm.

The species has not been bred and is very scarce in Bombay as far as is known. De Nicéville gives the distribution as Jaffna in Ceylon; Lucknow, Poona, Bombay, Mhow, and says that he had specimens from Masuri, Bholaghat, Malda, Barrackpur, Orissa, the Shevroy Hills and Ratnagi. To which may now be added Kanara District.

27. Genus Aphnæus.

"The genus is a most compact one and no one can fail instantly to recognise any species belonging to it, all having a facies peculiarly their own. In the great number of species the males have the upperside most beautifully glossed with rich, irridescent blue, which is only visible in certain lights. In no female does this coloration occur. The male has no secondary characters. In the case of species which have no blue coloration in the male, the male can be known by its more pointed fore wing, with the outer margin nearly straight; the female having the apex more rounded, the outer margin convex and the wings generally broader. All the species *have the underside traversed by several bands, usually of a darker colour than the ground, often outwardly defined with black, bearing a medial, metallic-silvery line.* The anal angle is produced into a lobe which is usually marked with orange on both sides and bears two black spots. All the species have two tails besides and the abdomen is striped. The flight of all the species of the genus is immensely rapid and can barely be followed by the eye, but they seldom fly far and frequently settle with closed wings on low-growing flowers and bushes. In Sikkim males may be taken in large numbers sucking up moisture on damp spots in the partially dried-up beds of streams, &c. Species of the genus appear to occur almost everywhere; in the plains they are found even in the desert tracts as well as in the regions of heavy rainfall and profuse vegetation; in the Himalayas they occur throughout the outer ranges up to an elevation of 8,000 feet." Thus de Nicéville. They also occur on the sandy sea-shores within a few feet of high water-mark. The above italics are not de Nicéville's. The undersides are the chief characteristic of the insects and, once seen, cannot be mistaken. The outer boundaries of the bands are always very distinct and generally differently coloured to the ground and the silver middle line is always a striking feature—a glance at the figures of *Aphnæus vulcanus*, 52 and 52a of Plate G will give a good idea of this. The larva is also a type by itself. It is rather oblong in form with the dorsal line straight, *the head never completely hidden under segment* 2, the surface covered with a clothing of minute disc or star-topped hairs or tubercles and a few somewhat scattered hairs round the body and the *mouths of the organs on segment* 12 *prolonged into short, permanently exserted cylinders.* All of them are attended by ants as far as is known and probably have many different foodplants. The genus "is particularly well represented in Africa" (*Distant*), "one or two occur in Persia and Asia Minor, about 20 have been recorded from India, several occur in the Malay Archipelago. Mr. Moore has recorded six from Ceylon." (*de Nicéville*). De Nicéville says "30 have been recorded from India" but he himself only enumerates 23, some of which are rather doubtful; so, presumably, he meant 20.

176. Aphnaeus vulcanus, Fabricius.—Male (Pl. G., fig. 52) and female (Pl. G., fig 52-a). *Upperside:* both wings fuscous fringed with hoary, somewhat shot with violet in the male. Fore wing: with four abbreviated, unequal, undulate, fulvous bands. Hind wing: with a fulvous, anal patch marked with two black ocelli or spots, the inner one capped by a silvery lunule. *Underside:* both wings sulphur-coloured with broad, fulvous faciæ or bands, each adorned with an interrupted, medial, silver line and bordered with a sub-undulate, black line. Fore wing: with the bands six in number; the two exterior, one marginal, the other submarginal, complete, parallel with the margin, the outer unadorned; the third diagonal substitute, almost halved; the fourth complete and bifurcated from near the middle of the disc upwards to costa or there may be two: a short one, diagonal, from the costa to the end of cell and a complete one parallel to it and inside from costa over the discocellulars to inner margin; the fifth almost halved, broken off towards the anal area; the sixth basal, also oblique, the shortest of all. Hind wing: also with six fasieæ: the outer two marginal of which the one is interrupted; the second, complete, archedly produced to inner margin; the third halved, joined with the second at middle; the fourth and fifth complete, suddenly inflected in the anal region; the sixth narrow, basal, contiguous to the body; the anal region fulvous, bearing two most black, occellar dots. Expanse: 20-40 mm.

On the underside of the hind wing, instead of the terminal band there is a row of elongate, black spots in the interspaces followed by an anteciliary, fine, black line. *Cilia* of both wings, above and below, nearly pure white with their extreme bases, black. Two thread-like tails to the hind wing, one directed straight down, the other out diagonally sideways, the one from the end of vein 1 the longer, the other from vein 2 only half the length, both orange at the base, black in the middle and white at the end. Antennæ black, banded finely white on the sides, the top and bottom immaculate; the club long rounded, the tip orange. Palpi black above, the point of terminal segment orange-tipped, the sides of second joint silvery; abdomen brown above, reddish at sides, banded very light yellow; thorax bluish-grey. All these very light yellow below. There is a slight fringe of longish hairs along the inner margin of the fore wing.

The above description is more or less that given by de Nicèville under Horsfield's name. He says "Variation seems to have simply run riot in this species as exemplified by Ceylon examples. There are males entirely black above with no orange bands and others with as many as five on the fore wing. Some males are glossed slightly with irrideseent blue on the hind wing, a very unusual feature in this species (Colonel Swinhoe possesses a male from Mhow which is similarly glossed and I have one form Simla, one from Barrackpur and two from Bangalore), but the markings of the underside undoubtedly proclaim them to be *A. vulcanus;* lastly the markings of the underside vary from broad, almost confluent, deep-red bands to narrow, ochreous ones: the two short, discal bands on the fore wing are sometimes free, sometimes joined to the third and sixth bands respectively, likewise the fourth band on the hind wing is sometimes free, sometimes joined to the fifth. I have entirely failed to split up these varying forms into distinct species as they run one into another in every direction." Which is all very true. The markings *are* most variable and it would be next to impossible to make any one description to fit all the vagaries.

Egg.—Dome-shaped, broadest just above the base. The surface covered with 4 and 5-sided, deep, coarse-walled, flat-bottomed cells; about 6 from top to base, the top cells being the smallest; all irregular in size: on apex is a circular, rather large, flat-bottomed depression: at all intersections of cell walls there is a thickening not amounting to a rising or spine; surface shining. Colour green with the cells-walls all enamel-white. B: O. 8mm; H: O. 5mm.

Larva.—Is an unmistakable *Aphnæus* in *shape.* The body is more or less parallel sided, somewhat feebly convex transversely, flattened ventrally; segments 2 and 14 rather broad: the former of ordinary segment-shape feebly tansversely convex, somewhat thickened on front margin, indented in dorsal line on the front margin, the thickened margin slightly turned up—there is no dorsal depression ; the anal segment squarish, the lateral corners, however, broadly rounded and the posterior edge even perhaps a little concave : the sides of the segment even slightly, also, converge forwards : the dorsum is moderately flat ; the dorsum of segment 2 is perhaps a little concave longitudinally, the front margin of segment 3 suddenly a little higher in level ; there is no sign of segment 13 ; segments 3-10 all of the same breadth and height, the last being a little lower than 9 ; segments 11-14 sloping to the somewhat turned-up, hinder margin of 14 ; segment 12 bears the cylindrical, prominent, permanently exserted little towers from which the white-pink cylindrical organs are protruded occasionally ; these towers are obliquely truncated at the top and bear four or five simple, cylindrical, square-topped (not pointed that is), longish hairs around the edge ; there is not a vestige of a spiracle to be seen on this segment 12 ; segment 11 has the hinder margin displaced forwards somewhat just in front of these towers so that there is a deep fold just before it on each side at the bottom of which is placed the spiracle ; the gland from which the honey is exuded is very short transversely and placed on the back face of a slight dorsal prominence ; immediately before each tower of segment 12 is a small round swelling with some of the translucent, simple, truncated hairs on it ; the other segments are normal, segment 10 a little longer than 9. *Head* only semi-hidden, rather large, shining black in colour with a large, triangular clypeus : the surface smooth except on the basal half of the face where there is a dense clothing of white, very minute, fine, somewhat appressed, branched hairs ; colour of labrum light, ligula brown, basal antennal joint red, second joint blackish ; mandibles dark, eyes light. *Spiracles* small, nearly round, slightly convex, light brown or yellowish ; those of segment 2 slightly larger. *Surface* of larva dull except on dorsum of segment 2 and segment 14 which are shining even underneath the clothing : this clothing consists of a dense covering of minute, branched (sometimes disc-topped) hairs : the vast majority of them stemless or nearly so, most of them glassy-shining ; some black ones mixed with them ; these hairs shortly but distinctly stemmed in the spiracular regions of the body ; a fringe of a single row of much longer, minutely feathered, erect, truncated, white hairs on dorsoventral margin all round the body : the hairs being rather sparse, longest and densest at both ends of body—none of them being even half as long as the body is wide ; there is a row of some 6 simple, translucent, truncated, cylindrical hairs between the tower-bases and there are a few much shorter ones across body on each segment near the hinder margin, each segment 2-11 has a dorsal, circular central depression or dent on it. The *colour* of the larva is green (sometimes grey-brown) with a darker green dorsal line centred by a thin white one (or a dark green, narrow band centred by a white line), an indistinct lateral, white line with a black spot beneath and touching it on segments 3, 5-10 ; also a darkish green, indistinct, supra spiracular line ; anal segment dorsally all shining dark-brown with lateral brown line diverging at the ends parallel to the outer boundary of the dark-brown area : towers of segment 12 and area between them dark reddish brown ; segment 11 with a longitudinal dorso-lateral, very broad reddish-brown band ; the whole of segment 2 and the front margin and lateral region of segment 4 both reddish-brown ; these reddish-brown parts shagreened with the little silvery star-branched, stemless hairs ; true legs shining green ; prolegs green. L : 18 mm ; B : 4·5 mm ; H : 33 mm.

Pupa.—The *shape* is that of any ordinary pupa of the *Zizera-Polyommatus* group ; the 13th segment is very large though not particularly broad, convex both longitudinally and transversely, forming the rounded end of the pupa with the anal segment right underneath it ventrally ; segment 12 is a short band, less than half the length of segment 11 which is shorter than 13 ; segment

11 has the spiracle situated at the bottom of a considerable highly-shining hollow which is characteristic. The front end of the pupa is bluntly rounded; the shoulders somewhat suddenly prominent though rounded, and the pupal breadth at these shoulders is very little, if any, narrower than at middle; the thorax is somewhat prominently "humped" and long; the head vertex is long and perpendicular to the longitudinal axis of pupa, its hinder margin curved convexly backwards; segment 2 is a broadish transverse band, flattened dorsally with a depressed, dorsal dent from front to hinder margin and is in a plane inclined at an angle of 45° to that axis, the hinder margin straight; the thorax has its middle portion parallel to that axis, the hinder and front slopes at about 30° to the axis, its hinder margin nearly triangularly bent except that it is rounded at the apex (of the triangle) in the dorsal line, this hinder margin meeting the wings in a deep, rounded angle of about 60°; segment 4 is short in the dorsal line, long laterally; the proboscis inside the meeting point of the antennæ (which only reaches to within two-thirds the distance from mouth to end of wings) does not nearly reach the end of the wings, pupa highest at thoracic apex broadest at segment 7. *Spiracles* of segment 2 narrow, oval, black, hardly visible; the rest small, roundly oval, raised somewhat, red-brown or yellowish. *Surface* of pupa shining, smooth except for some minute, sparse, erect, white hairs only visible with difficulty under the lens and a slight depression laterally above each spiracle and a dorsal, central dent sometimes on segments 6-8; there is also the large spiracle-depression on segment 11 mentioned above; there is no sign of the 12th segment organs or the gland. The *colour* is either dark reddish brown or grass-green; in the latter case the abdomen with a yellowish tinge; a lateral, blackish, subcutaneous spot on segment 2, another smaller one at spiracle of segment 2, a brown spot at spiracle of segment 6; a dark green dorsal, abdominal line. L: 11 mm; B: 4·5 mm. at segment 7, 4 mm. at shoulders; H at thorax: 3·5 mm. at 7: 3·75mm.

Habits.—The eggs are laid anywhere (axils, leaves, stalks, dry sticks) on practically any plant where there are ants of the genus *Cremastogaster*—a particular species probably. The ants look after the little larvæ from the first and these do not get on well without them. When they grow larger they make little cells for themselves in any crease or hollow they can find in the leaf-surface, fastening the edges of the cell with silk and lining the inside thickly if somewhat slovenily. The pupation takes place in the cell at the end of the time and the duration of the pupal stage is about 10 days. The pupa is attached by the cremaster as well as by a body-band. The cell made by the larva is rather like those made by spiders, untidy and irregular and is used as a permanent abode, the inmate going out to feed on the undersides of the leaves, always leaving the cuticle of the upperside intact, even in the full-grown state. There are always many ants attending and they climb all over the caterpillers; a half dozen may sometimes be seen on one at a time. The butterfly is a strong flier but does not ordinarily fly far; gets up suddenly and drops suddenly to the ground or on to a bush or plant near the ground when disturbed. It basks on low plants, sitting with the wings well opened though never flat; rests with them closed over the back; goes freely to flowers and is easy to capture when thus engaged. It is one of the commonest of lycœnide butterflies and may be found practically anywhere in India, (except in the eastern Himalayas and Assam and does not extend to Burma), in desert Sind as well as in the heavy rainfall regions, as for example, the Western Ghats in Kanara in Bombay ; and it is just as plentiful there on the sandy shore of the sea-coast as in the open parts of the jungles on the crest of the ghats, 3,000 feet above. The pupa is sometimes found in withered leaves on the ground below the plant. It is attached by the tail and fixed by a body-band. The foodplants of the larva are varied and seem to depend upon the presence of ants more than upon anything else. It has been found on *Canthium parviflorum, Zizyphus rugosa* and *jujuba, Allophyllus cobbe* belonging to the families *Rutaceæ, Rhamnaceæ* and *Sapindaceæ* respectively and de Nicéville mentions having reared it on *Clerodendron siphonanthus* in Calcutta (*Verbenaceæ*). The butterfly exists from the outer ranges of the Western Himalayas where it is rare down throughout Continental and Peninsular India but not in the Eastern Himalayas, Assam or Burma ; Ceylon. It is said not to exist in desert tracts but it is plentiful enough in Sind.

177. Aphnæus iohita, Horsfield.—Male and female. *Upperside :* both wings dingily fuscous clouded with whitish, fringed with hoary-whitish ; darker to black in the male. Fore wing: in the male, from base to middle shining violet ; in the female with the fasciæ of the underside, showing through, obsoletely streaked. Hind wing : in the male, from base to middle shining violet ; in the female, like on the fore wing, with the fasciæ showing through, obsoletely streaked ; a large, triangular, fulvous, anal patch in both sexes, bearing two black lunules inwardly irrorated with silver ; an inner, larger, lunular ocellus on the lobe. *Underside :* both wings yellow with fulvous or red, transverse fasciae centred with dull silver ; in the male reddish-purple ; the marginal one simple, sometimes circular ; the others with the medial, continuous or very little interrupted dull silver line. Fore wing : with seven fasciae, two marginal complete, the exterior unadorned ; the third and fourth shortened and confluent beyond the disc ; the fifth complete, tending towards the anal angle ; the sixth halved, terminated at the fuscous band of the paler, anal area ; the seventh basal, smallest. Hind wing : with six fasciæ ; the two marginal, parallel, the inner one complete and produced curvedly towards the inner margin ; the third halved ; the fourth and fifth complete, abruptly inflected up the inner margin in the anal region : the sixth basal, short ; the anal region deep fulvous margin in the anal region ; the sixth basal. short ; the anal region deep fulvous, bearing two small, black ocelli, the exterior, between the tails, oblong and inwardly increased by a silvery band, the innermost larger, angular, placed on the lobe, bordered by a short, interior, silvery line. Antennæ black, white-banded at sides, with the club orange-tipped, long and gradual. *Cilia* of both wings above and below greyish ; a fine, jet-black, anteciliary line to both wings below ; the tails black with orange base and white tip, the one at end of vein 1 straight down, 5mm. long, the other 4 mm., at vein. 2 Head with vertex yellowish, but collar black ; frons white centred broadly black with some rusty hairs ; eyes white-rimmed. Palpi black above ; thorax bluish ; abdomen black dorsally, lateraly red. Below : all very pale yellow ; inner margin of fore wing with a long, brown fringe.

The description is mostly in the words of Horsfield from de Nicéville's Butterflies of India, Burmah and Ceylon. Horsfield is further quoted as saying "*A.*

lohita, Horsfield, has the upperside brown, slightly variegated with grey, especially in the female and marked with a few obsolete bands of a deeper tint; underneath the bands, comparatively with *A. vulcanus*, Fabricius, are narrow and wholly without any black, marginal thread; the bands in the forewing are *seven* in number, besides an obsolete, basal, angular spot, the *third and fourth are abbreviated, converging, approximate or confluent behind the disc;* in the hindwing *the third is postmedial, regularly transverse and without any tendency to the second, marginal band*: in the character of the fourth and fifth bands this species agrees with *A. vulcanus*, while both differ decidedly from *A. syama*, Horsfield." Then de Nicéville adds "*A. lohita* is a species which presents considerable difficulty as, in the large area which it inhabits, it shows much variability. Two of the forms have been figured by Mr. Hewitson; in one the red bands of the underside are very narrow and the two, short, discal ones of the forewing well separated. I have seen no variety of this figure in India agreeing with this figure; it is possible it may be the Sumatran form as Hewitson gives Sumatra and India as the habitat of this species. The other figure shows all the bands very broad and of a deep red, the discal bands confluent; this appears to be the form occurring commonly at Rangoon. A form intermediate between these two extremes is the common Himalayan one. Until recently, *A. lohita* was the name by which Indian specimens of this species were known, though the type was described from Java. Mr. Moore has however separated off several of these forms and described them as new species; but, I think, on very insufficient grounds. As lately as 1886, however, he gave *lohita* as from Mergui and his specimens from that locality are now before me. I cannot find that they differ in the smallest degree from Sikkim specimens of this species which he has named *himalayanus* for me. From Ceylon he has described *A. lazularia*. I cannot find in his description or in specimens of the species the slightest character by which they can be separated from *A. lohita*, and Mr. Moore in his description of the species admits its variability even from such a restricted area as Ceylon. I have kept the *A. concanus*, Moore, as a distinct species with considerable reluctance, the species having the ground colour of the undersides reddish-ochreous instead of yellow as in typical *A. lohita;* though Mr. Moore, in describing *A. lazularia*, says that this red form is a variety of that species only and occurring in the male; also *A. zoilus*, Moore, which appears to be typically confined to the Andaman Isles, and may be known by the bands of the underside being black instead of red, but Mr. Moore records this species from Mergui and the specimen before me is perhaps nearer to *zoilus* than to typical *lohita* as the bands are black tinged with red; and I possess a single female specimen from Ceylon which exhibits exactly the same character; lastly *A. zebrinus*, Moore, from Ceylon, which I have not seen."

From all of which will be seen that these *Aphnæus* butterflies are very variable and it is difficult to get one description that would fit all individuals of any species.

Larva.—Is a typical *Aphnæus* larva; in *shape*; more or less parallel-sided, segments 2 and 14 rather narrow, the head never completely hidden under segment 2 and the two organs on segment 12 with permanently exserted, short, cylindrical towers. *Head* large, nearly round in shape, somewhat depressed, shining, dark brown in colour with the face black; the dorsal line slightly depressed, with some few hairs at the clypeus and mouth-aperture. Segments distinct especially along the dorsoventral margins; segment 2 is transversely rather narrow, somewhat longer than broad (about equal to the anal segment in breadth), concave longitudinally, the margins being somewhat turned up, smooth with a shining, red-brown border, with a fringe of long, dense, feathered or minutely bristle-bearing hairs on the lateral and anterior margin; these hairs some brown, some translucent-whitish and of different lengths; anal segment, sloping very gently backwards, has a large, shining, smooth, dorsal depression occupying nearly the whole surface and bordered thinly light, is rounded at the extremity rather broadly and has hairs on the margin like segment 2, the body is transversely convex, longitudinally and dorsally straight from segment 3-12; segment 13 is visible dorsally; segment 12 very short, the organs provided with a permanently exserted, cylindrical, longish tube with a dentate edge to the opening, and some hairs round the mouth, from which is protruded a short, white body with a brush-end; the gland on segment 11 is transverse, close to the hinder margin and not easily seen; ventrum flat. *Surface* of larva is covered with minute star-topped, silvery hairs or tubercles, those on certain places taking the colour of the ground; a dense fringe of rather long, white, erect hairs all round dorsoventral margin as well as transversely across segment 13 between the bases of the organs; on the dorsum of segments 4 to 9 there may be a central, depressed-looking, circular, black mark. *Spiracles* quite large, oval and the colour of the body. *Colour* of body is greenish covered all over thickly with brown speckles (or smokey-brown); the whole body dorsally, as far as a lateral line, dark-grey; a double black dorsal line (or none); each segment 3-9 may have a red-yellow mark along posterior margin, one on each side of dorsal line; each segment 3-11 may have a short, dorsolateral streak, white or a white spot on a dark ground; front margins of segments 2-4 also reddish-yellow and the occiput of the head may be the same colour. L: 20mm.; B: 4mm.; H: 3·5mm.

Pupa.—The *shape* is more or less normal except that the anal segment is somewhat horse-hoof-shaped; the body rather narrow. Segment 2 comparatively rather narrow and short, hiding the head from above, transversely convex, semicircular in front, slightly carinated in the dorsal line (very slightly), slightly triangularly emarginate in dorsal line of front margin; the *head* has the frons in a place perpendicular to the longitudinal axis of the pupa or even a little inclined ventrally, the frons rounded and high; the lateral margins of segment 2 are parallel, the shoulders somewhat prominent and a good deal broader than segment 2 and are lumpy-rounded, wings having their inner margins also parallel from shoulders to segment 8, the abdomen perhaps a little broader than shoulders about segment 8, then decreasing to the end which may either be somewhat turned under or not and is slightly horse-hoof shaped as far as the last segment is concerned; the dorsal line of segment 2 rises very gradually towards hinder margin; thorax only slightly humped, the dorsal rise from segment 2 gradual, the apex rather for back with the descent to segment 4 short and steep, the dorsal line perhaps slightly carinated, convex transversely; the dorsal line of abdomen afterwards curved to end in a quarter-circle; the slope of the "horse-hoof" is steep and the suspensory surface on its ventral aspect is long and narrow; the wings and segments all well-marked; gland-scar a transverse slit; organ-scars raised, circular with a hole in their middle. *Surface* very shining with a clothing of rather sparse, very minute, short, erect, dark hairs, especially dense round the spiracles. *Spiracles* of segment 2 hardly noticeable; others small, inconspicuous, oval, convex, coloured like the body. *Colour* dark brown-red or brown-olive with the sides of abdomen and ventrum lighter-yellowish; it is speckled-looking. L: 13mm; B: 4·75mm; H: 4·75mm.

Habits.—The eggs are laid on trees where there are ants of the genus *Cremastogaster*; the larvæ live, to the number of 2 to 4, huddled close together in dead, dry leaves where the ants build temporary sheds over them to protect them; they eat the substance of the leaf without touching the upper cuticle—they are generally found on fairly old leaves, but if given young, tender leaves they will eat like any ordinary larva; when full-grown the larvæ make cells for themselves by loosely drawing the edges of a leaf or part of a leaf together in a careless-slovenly way. They may pupate inside such a house or they may go off and change in a crevice somewhere. The suspension is by the tail only and the pupa touches the surface only with the head and tail so that daylight can always be seen below it. The butterfly seems to be an inhabitant of the rain-forest country altogether and it probably never ventures anywhere near the Plains. In Kanara in Bombay it is found chiefly in the evergreen jungles on the Western Ghats and is, there, not rare though by no means as common as *vulcanus* is a bit further out in the opener country. It is, of course, very strong on the wing but never flies any great distance as far as has ever been observed, nor does it ever keep long on the wing like certain butterflies (Skippers, *Discophora*, *Euplœa*, &c.), beating backwards and forwards over the same ground. When put up out of foliage it darts off and disappears into the leaves and growth a bit further on. It does not go to the tops of hills and trees to bask either though it basks on the leaves of bushes in thick places in the jungles when the sun is hot and the atmosphere steamy and damp. It does not, seemingly, like wind and exposed places. It is not often seen though it comes readily enough to flowers of such low shrubs as *Leea*, *Allophyllus*, &c. It may then be caught easily enough for it is not quick at rising whatever its character may be when once on the wing. With regard to the form *concanus* which de Nicéville says he has kept as a distinct species with considerable reluctance, it was bred in Kanara from larvæ that were practically identical with those of *lohita*; also in the particular locality where *lohita* constantly bred out from the larvæ found, the form *concanus* was about the only one to be caught outside. It is certain then, or nearly certain, that *concanus* is the dry-weather form of the other for the insects were all bred in the month of February, and caught. The atmosphere in the cages in the bungalow was much damper than that outside and, certainly—and it is believed that this is *the* determining factor for the difference in form—the food given in captivity was of the youngest and tenderest. Outside there were few new shoots and the majority of the larvæ must have had to content themselves with what leaves they could get at, mostly, then, old and tough. Description of the larvæ obtained in February were carefully kept and they differed but little from those obtained in the monsoon months in other places—the differences being in colouration only which is variable, as is well known, with temperature and humidity. As luck would have it no completely authenticated eggs could be obtained of either form so that absolute certainty is still a *desideratum*. However, as far as the writer is concerned *concanus* is the dry-weather form of the wet-season *lohita*. The foodplant of the larvæ is, ordinarily, *Terminalia paniculata* but they have also been bred on *Dioscorea pentaphylla*, always and invariably attended by ants.

Aphnæus lohita is "the commonest species in Sikkim" according to de Nicéville. He further states that it occurs throughout the

Himalayas and in Assam, Burma, Malacca, Penang; Orissa, the Nilgiris and Ceylon. It is also found on the Western Ghats in Belgaum and Kanara in Bombay from sea-level up to 3,000 feet.

178. Aphnaeus lillacinus, Moore.—Male. *Upperside:* both wings brown. Fore wing: with the basal area, including the cell, pale lilacine-blue; a blackish spot at the end of cell. Hind wing: the basal and medial areas pale lilacine-blue, anal lobe ochreous with a very small, silver-speckled, black spot. *Underside:* both wings: pale brownish-ochreous. Fore wing: with two black rings in the cell, a band at the end of the cell dilated beneath and extending obliquely to the submedian nervure; a ringlet spot beyond the end of the cell; an upper, discal, inwardly oblique, double ringlet-spot and a submarginal, broad, chain-like band, the lower ends dusky: each traversed by a silvery streak. Hind wing with very indistinct traces of darker-coloured, transverse, subbasal, discal and submarginal bands which are traversed by silvery and black streaks; anal spots minute and silver-speckled. The silvery streak traverses the middle of the markings, except on the submarginal band of both wings where it extends along the border. Female. *Upperside:* both wings dull brown and of course lacking the irridescent, blue colour present in the male; the wings broader, the outer margins much more convex. *Underside:* both wings as in the male. Expanse: male, 28-35 mm; female, 30-40 mm.

The description is taken from de Nicéville's book. He says it is a variable species, like all the rest and that it has been found only at Bholaghat, Malda, Bombay and Mhow; that it is "quite peculiar, and has no near ally." Nothing is known as to the transformations.

179. Aphnaeus ictis, Hewitson.—Male. *Upperside:* both wings purple violet-brown or black; lower discal areas glossed with brilliant ultramarine blue. Fore wing: with a small, triangular, orange-red spot. Hind wing: with the anal lobe also red, spotted with black. *Underside:* both wings pale, dull sulphur-yellow, the transverse markings of a slightly darker ochreous-yellow, all with a black-bordered line and medial, silver streak; exterior margins with a row of slender, black spots. Female. *Upperside:* both wings brown, basal areas greyish vinous-brown. Fore wing: with the orange spot large, broad, obliquely divided and occupying the discal area. *Underside:* as in the male.

The above is Moore's description of the Ceylon insect contained in de Nicéville's book; it is complementary to the following original descriptions of Felder and Hewitson, written in 1868 and 1865, respectively:—

Male.—Smaller than the female of Hewitson; with the fulvous spot on the upperside of fore wing smaller or wanting; the anal spot on the hind wing dull and smaller. *Underside:* brownish, the transverse bands paler and broader; the anal spot of the hind wing also much smaller, rounded and obsolescent. Female. *Upperside:* both wings rufous-brown. Fore wing: with a large, medial, orange space, a spot in the cell, an oblique, transverse band in the middle, a single spot near the costal margin, followed by a short band of two spots and an oblique band (which borders the brown of the outer margin and forms a triangle with the medial band), all dark brown. Hind wing: with the space between and above the black anal spots orange. *Underside:* both wings orange-yellow, with the transverse bands rufous, bordered narrowly with rufous-brown, traversed by spots and lines of gold, the submarginal band composed of minute brown spots.

Antennæ black, the shaft banded white at sides; the club stout, rounded, orange-tipped. *Cilia* in both sexes, above: white with fine, anteciliary, black line; below: sullied greyish. Palpi black above, silvery at sides of second joint at end, thorax greenish blue above; abdomen red with a black, dorsal line; all light yellow below, the abdomen with long, slatey-blue hairs at base. Head with the vertex red, the collar black; frons red with a broad, black central line; eyes red-rimmed. There is a long, grey fringe of hairs along inner margin of the fore wing. Tails: the longer, at vein 1, being 4 mm: the shorter, at vein 2, one-quarter the length.

De Nicéville gives a key in which he tries to differentiate 23 forms-of *Aphnæus* but fails to find any constant characters by which he can separate *lohita* from *concanus, zoilus, zebrinus* on the one hand and *ictis* from no less than 12 forms on the other, although he considers that no more than six of these are good species after careful examination of long series of most of them. He concludes, in this way, that *uniformis, elima, lunulifera, nubilis, khurdanus* and *trifurcata* are all varieties of *ictis. Ictis* inhabits Northern India, Kashmir, Ceylon; *trifurcata*, Northern India Dharmsala; *khurdanus*, Calcutta, Khurda, Orissa; *nubilis*, Ceylon; *lunulifera*, Darjiling; *elima*, Manpuri, N. W. India, Kangra Valley, Mhow, Poona; *uniformis*, Mount Meru, Wurdhan. The distribution rather supports the idea that they are all mere varieties of a variable *ictis.*

Considering all this talk about varieties and variations, it is no wonder that there is no record of the habits of the butterfly. All the writer knows about it is that it is very quick on the wing and comes freely to flowers in Dharwar during the monsoon months. Dharwar is Plains country and very open so that, as the insect has never been met with in forest-covered Kanara or Belgaum, it probably eschews jungles and very heavy rainfall and is characteristic of the Plains.

180. Aphnaus hypargyrus, Butler.—Male. *Upperside:* both wings fulvous, dusky at the base and on the costa. *Cilia* whitish. Fore wing: with all the bands on the underside represented above, but they are dusky-coloured, the outer and inner margins also dusky; the apex with a small, suffused, whitish patch, sometimes obsolete. Hind wing: with two discal, more or less interrupted, dusky bands from the costa; a submarginal curved band (sometimes macular) from the costa to vein 3; the outer margin with a series of conjoined, rounded black spots; sometimes a complete band; the anal lobe small, black, with a few silvery spangles. *Underside:* both wings chalky-white, all the bands and spots ochreous outwardly, narrowly defined with black and sparsely spangled with silver in the middle; a series of short, linear black marks between the veins; a fine, anteciliary, black line. Fore wing: with a small streak at the base of cell; a band across its middle joined to a basal, fuscous patch below the median nervure; an oblique, discal band; two short bands from the costa beyond forming a V-shaped figure more or less disconnected; a submarginal, catenulated band. Hind wing: with some small, basal marks; three subbasal spots in a straight line, the two upper ones sometimes joined; a discal, continuous band recurved upwards to the abdominal margin with a ring-spot on the margin anterior to the posterior end of the band; a short, sinuous band beyond from the costa to just below vein 4; a sinuous, submarginal band, recurved and broken at its lower end; anal lobe with a prominent, black spot which is sometimes surrounded with ferruginous. Female. *Upperside:* both wings somewhat darker and duller coloured than in the male, the wings rather broader. *Underside:* both wings as in the male. *Cilia* pure white both above and below, with a fine, brown, anteciliary line below. Antennæ brownish, banded thinly white; the club gradual, stout, tipped orange. Palpi pale yellow above and below, the tip of third joint brown; the third joint long, longer in the female than in the male. Thorax light yellowish-brown above, abdomen light fulvous, banded very pale yellow; below: thorax and abdomen very pale yellow. Head with the vertex and frons very pale yellow, the latter with a central, fulvous line. Inner margin of fore wing with a longish, light brown fringe. Tails fulvous at base, brown in middle, tipped white, that at end of vein 2 very short. Expanse 25·40 mm.

The above is de Nicéville's description. He goes on to quote Butler: "Allied to *Spindasis* (*Aphnæus*) *acamas*, Klug, and to *S. epargyrus*, Eversmann. Larger; the male differing from both on the upperside in the whitish costal area of the fore wing and both sexes differing in the darker bands on the wings. *Underside:* chalky-white instead of cream-colour, all the markings darker and edged with black; the submarginal band of the hind wing is not angulated as in *S. acamas* and the hind wing itself is longer." Butler says *hypargyrus* represents *acamas* in N. W. India, that Colonel Swinhoe got it in Karachi and Chaman, Major Yerbury at Cambellpore and he finally concludes that there are three constant local races: *hypargyrus, acamas* and *epargyrus.* De Nicéville is not inclined to believe that *acamas* is distinct from *hypargyrus.*

All of which again goes to prove that the species of this genus are extremely liable to variation. *A. hypargyrus* is common in Sind and is recorded from Chaman, South Afghanistan, Bhooj. It is evidently confined to the more or less desert parts of the N. W. of India.

The following life history of the species is taken from a note by Captain F. C. Fraser, M.D., I.M.S., published at page 529 of J. B. N. H. S., vol. XX, part 2, which is accompanied by a black and white plate representing the imago male, female and underside, the larva, pupa and egg as well as some details of the larval structure:—

Egg.—"The egg shown in the plate, fig. 1, is the size of the head of a No. 10 entomological pin and is not unlike the spineless shell of *Echinus esculentus.* It is dome-shaped, flattened on the resting surface and presents a pit at the apex of the dome. The upper surface is mammellated and finely pitted between the mammellar processes. In colour it is a dead white and is an exceedingly beautiful object under a lowpower microscope."

Larva.—"The larvæ appear first as tiny, hairy, mahogany-red creatures. The head from first to last moult is jet-black. The hair of the first skin is coarse and white with the exception of eight black hairs which project horizontally back from the rear of the 13th segment. The full-grown larva is a prettier object than the generality of its class. Fawn is the prevailing colour, but the mahogany-red tint persists on the first three segments and on the dorsum of the 11th, 12th and 13th; there is, however, a small patch of fawn on the sides of first two segments. There are fine, double lines of mahogany-red along the back and sides and a row of dots of the same colour extending from the 4th to the 10th segment. On the dorsum of the 2nd segment is a shiny, black, chitinous plate beneath which the head of the larva is retracted when alarmed. On the back of the 12th segment two fleshy pillars surmounted by three stiff bristles arranged in an equilateral triangle. These pillars are hollow and from them project fine hairs; when the larva is irritated a fleshy tongue is flickered in and out of these with great rapidity very much in the manner of a snake's tongue. A diagram of these pillars is shown in fig. 2, the latter representing the tongue projected and showing the fine hairs attached to its tip. The larva viewed under the microscope shows a remarkable arrangement of star-like, fleshy processes which cover the entire skin so closely as to form a complete, net-like coat. Fig. 3 shows a portion of the skin at the site of one of the lateral spots, viewed from above; and it will be observed that the colouration is confined to the stellate processes. Fig. 4 shows them in profile."

Pupa.—"The pupa is blackish or dark-brown in colour. The head is rounded and stands out in relief from the body by reason of the very prominent shoulders. The abdomen tapers gradually."

Habits.—"*A hypargyrus* (Butler) is confined to N. W. India, Sind and Afghanistan in particular. These notes are made from specimens captured on the wing or bred from ovæ at Hyderabad, Sind. In this place, the insect is locally plentiful, being restricted, as far as I have observed, to two small areas of rather more than one acre in extent. The country, for some miles round, furnished no specimens. The imago is too well-known to need a further description here, but I have shown in the plate, figs. 7, 8 and 9, the upper sides of male and female and underside of a female. They are generally seen in small groups of three or four, settling on or fluttering round low bushes or herbs at the corners of intersecting pathways or roads. The ovæ are deposited usually on a dead twig in juxtaposition to the food plant or they may be laid on the bract at the base of a leaf-stalk. On the 5th day the larvæ hatch out. When the larva is at rest it will project the tongue-like processes in and out, about every ten seconds, and will continue doing so for long periods. I was not able to determine whether this action was protective in nature or for the purpose of signalling up ants. I know that it was carried on for a long time preparatory to spinning the cocoon. Like most lycænid larvæ these are always attended by ants and this fact is of great use in searching for them, as it is easier to notice the ants than to see the larvæ. When moulting the larvæ spin two or three leaves together in which they lie until the change is effected. Often two or three will go into partnership to build this temporary cocoon, but as soon as the cocoon is finished the partnership is dissolved, and they wander off in different directions. The partnership is almost invariably brought about by the agency of ants, who pilot the larvæ to a suitable spot. The final cocoon is but a little more compact than the temporary ones and usually consists of two leaves loosely woven together and open at both ends. The pupa is firmly fixed by the tail to one portion of the cocoon. It hatches out in from ten days to some weeks, this depending on the season. The foodplant is *Cassia* and they show a partiality to the young buds." It is probably *C. fistula* or *auriculata*.

28. Genus CHLIARIA.

" As restricted by me,the genus *Chliaria* contains but four species, one of which *C. cachara*, Moore, seems to me to be very doubtfully distinct. . .The four species that are left in *Chliaria*, are small insects with the ground-colour of the upperside black; in the male of *C. othona*, Hewitson, the basal half of the fore wing and nearly the entire hind wing is pale blue ; the fore wing glossed with rich purple-blue, especially on the outer black portion in some lights ; the underside is white with ochreous, brown and white spots and bands. . . . .The females of *othona* and *kina* differ widely from their respective males, being dull fuscous on the upperside without any trace of blue, the discal areas in both wings being whitish in *kina*, which is also, sometimes, the case in *othona*. . . . ." (*de Nicéville*, Butt. of I., B. and C.).

De Nicéville also says that no transformations have been described but mentions that the larva of *othona* was once found feeding on an orchid. This discrepancy has since been remedied for *othona* has now been very frequently bred, first by E. H. Aitken at Castle Rock in North Kanara District on the borders of Goa in the Western Ghats of Bombay ; subsequently by others in the same district. The larva and the eggs are easy to find and can be obtained there in any desirable quantity. The commonest foodplant is the orchid *Cottonia macrostachys*, but it feeds on others as well, always choosing the flower buds. The larva is of normal shape but has two tail-points. The butterflies are not particularly strong fliers. The pupa is normal. The genus occurs in the Himalayas, Assam, Burma, South India, the Andamans and Ceylon.

181. Chliaria othona, Hewitson.—Male. *Upperside:* both wings pale cærulean blue. Fore wing with the apical half rufous-brown or black. Hind wing with the apex black. *Underside:* both wings white, crossed beyond the middle by an irregular band of rufous spots commencing in a large spot at the costal margin of each wing; both with a submarginal, rufous line. Fore wing: with the costal and outer margins rufous. Hind wing: with a black spot near its base and two black spots near the anal angle, each crowned with orange.—Female. *Upperside:* both wings rufous-brown, paler towards the anal angle of the hind wing. Hind wing: with two tails; some submarginal, brown spots; and a line of white below them. *Underside:* both wings white, tinted with lilac near the base; a submarginal, rufous line. Fore wing: with a line at the end of cell; a short band beyond the middle from the costal margin; a line below it and the apex rufous. Hind wing: with a broken, rufous band at the middle, commencing near the costal margin in a black spot; the lobe and a spot outside the tails black, bordered above with orange-yellow, the space between them irrorated with silver. (*Hewitson*). Doherty says:—Male. *Upperside:* beautifully glossed with dark blue on the fore wing beyond the cell, seen only in certain lights.—Female. *Upperside:* the pale blue of the male replaced by a pale grey area from the hind margin of the fore wing to vein 3. Hind wing: with a similar area (without any trace of blue) extending nearly to the margin where there is a dark, subanal spot with fainter ones near it; marginal black and white edge-lines as in the male. *Underside:* like the male, marks somewhat paler. Hind wing: with the subanal, black spot bordered narrowly with pale ochreous. Wings wider and more rounded than in the male.

Egg.—More or less hemispherical, slightly depressed, surface covered with thick-walled cells or depressions, there being four from the apex to the base, the summit being occupied by a central one. Colour white, the ground being green but completely obscured by the white cell-walls. B: O. 75 mm; H: O. 55 mm.

Larva.—When it first emerges from the egg it is a little yellow thing with long hairs on its back; in the second stage it gets brown-red lateral bands and becomes greenish. The *head* is not hidden under segment in the first stage but is afterwards. Head of fully-grown larva: shining, translucent, shining light yellow with brown-tipped mandibles. The general *shape* is of the usual wood, louse form but the anal segment is trapeze-shaped instead of rounded at the extremity, it is flat on dorsum and ends in two distant, short, fleshy, conical points, one at each corner; the segments are all well-marked; segment 2 has the dorsal depression diamond-shaped, large and is itself more or less semicircular in shape; the gland is transverse, rather large, mouth-shaped with shining black lips; the organs on segment 12 are present with circular openings. The *surface* is dull and covered moderately closely with short, dark, erect hairs. The *spiracles* are small, round and black. The *colour* is light green with a broad, dorsal, brown-red band; a similar, lateral band but narrower; a similar, subspiracular band, as broad as the dorsal one, covering completely the last three segments 12-14. These bands all become obsolescent before pupation. L: 12 mm; B: 3·5 mm.

Pupa.—Is normal in shape, somewhat stout, with no constriction. *Head* completely hidden from above by segment 2; segment 2 rounded as to front margin; anal end also rounded ; thorax at apex the same height as abdomen at segments 6-7; breadth at shoulders the same as breadth at segment 9. *Surface* glabrous, pitted all over with minute points; mark of gland a transverse, indistinct line with a black dot at each end. *Spiracle* of segment 2 hardly visible, a black spot where it should be; other spiracles small, oval, light in colour. *Colour* generally green; thorax and abdomen suffused with pale pink; a dark, obsolescent, dorsal band; also a lateral similar one; a black spot on shoulder and one above and below each spiracle on abdomen; along wing-line on thorax is a shining, black, triangular patch and a similar one behind it on segments 4, 5. L: 10 mm; B: 4·75 mm.

Habits.—The eggs are laid on the flower-stalks and buds of plants in shady places in the jungles. The larva on emerging from the egg enters a flower-bud and feeds on the inside; but soon, as it grows, sits on the outside and eats holes in the buds. It always prefers buds to the full-blown flowers but will eat these latter when obliged to do so. It is an inert caterpillar and moves very slowly and deliberately. The pupation is effected upon a flower-stalk or a leaf of the orchid; often the larva wanders away to the trunk of the tree to change into the chrysalis. The suspension is by the tail and a body loop. Ants do not visit the larva much though they are occasionally found on the flowers and plants. The butterfly is not often seen; it does not go to flowers nor to water and the haunts where it passes its time, are, like in the case of so many other Blues, a mystery. It has occasionally been seen round the foodplants by the writer but, otherwise, never. It is an insect of the forests and hills and heavy rainfall and will not be found in the Plains. The foodplants of the larva are all epiphytic orchids and it has been found on *Cottonia macrostachys, Ærides crispum, Rhynchostylis retusa* and a few others. The butterfly has been recorded from Northern India; Kumaon, 4,000 feet, Sikkim, Bhutan; Assam: Cachar, Khasi Hills; Chitagong Hill Tracts; Burma; South India: Kanara District of Bombay.

182. Chliaria nilgirica, Male. *Upperside:* brown. Fore wing: without markings but shading darker at the costa and outer margin. Hind wing: with the abdominal fold grey, with a fringe of white hairs; a small, black spot on the inner side of the anal lobe and a still smaller and indistinct, black spot in each of the next two interspaces, the two latter capped with dull orange, all three outwardly edged with white; tails black, tipped and fringed with white. *Cilia* brown with white tips. *Underside:* creamy-white with the markings dull orange. Fore wing: a thin line at the end of cell; a discal band commencing at the costa with four, thin, annular marks, the first three spots outwardly oblique, the fourth straight below the third, the band continued in very thin lunules almost straight down to the submedian vein; a submarginal, lunular line. Hind wing: with a black rather prominent, subbasal spot below the costa; another, somewhat larger, outside, also below the costa with the discal series running down from it in one disconnected, thin line; then two annular, thin marks in the middle followed by a thin, sinuous line which curves in the form of the letter W on to the abdominal margin one-fourth above the anal angle; a small, black, anal spot; another in interspace 2, both faintly crowned with orange; a submarginal, lunular line as on the fore wing. Antennæ black, ringed with white; club with a dull orange tip; head and body above and below concolourous with the wings.—Female. *Upperside:* blackish-brown. Fore wing without markings. Hind wing: with a small, black, anal spot; a larger, subterminal spot in each of the next two interspaces; a small spot in each of the next two; the last four prominently capped with white lunules; terminal black line with an inner, white thread. *Underside:* as in the male. Expanse: male, 27·5 mm; female, 35 mm.

The transformations are not known or, at any rate, have not been published. The insect inhabits the Nilgiris and Ceylon and might possibly occur on the Ghats in Bombay.

INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S.

(*With* 14 *Text-figures*)

(*Continued from page* 141 *of Volume XXVI*)

Part IV.

Genus—PALPOPLEURA.

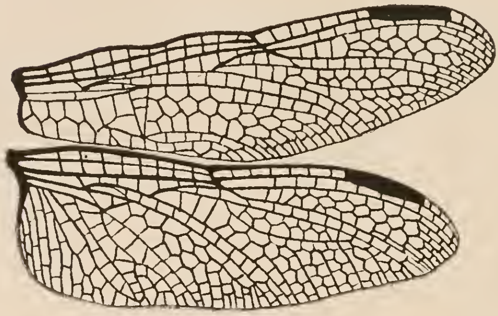


Fig. 29.—Wing neuration of *Palpopleura* (× 2).

Palpopleura, Rambur, Brauer.

Hemistigmoides, Calvert.

Libellula, Fabricius, Burmeister.

Head moderately large ; eyes moderately contiguous ; forehead narrow, in the male often flattened and with a straight, sharply edged foreborder, the mid suture very shallow ; in the female the forehead less prominent, the foreborder indistinct and somewhat rounded ; vesicle high and slightly notched.

Prothorax lobe fairly large, quadrilateral furnished with a ruff of long hairs.

Thorax moderately robust.

Legs slim, moderately long. Male : hind femora with numerous short spines, and a longer distal spine, mid femora similar but the spines somewhat longer ; tibial spines very numerous, slim and short ; claw-hooks small, situated near the apex. The leg armature of the female almost identical.

Abdomen short, broad and depressed. Parallel-sided in the male, somewhat fusiform in the female. A transverse ridge on the 4th segment.

Wings short and moderately broad, usually broadly coloured or marked with black or brownish black; the costa, about midway between the base and the node, with a shallow notch; trigone in the forewing slightly distal to the line of the trigone in the hind; sectors of the arc in the forewing either separated or more often very shortly fused, in the hind a somewhat longer fusion; arc between the 1st and 2nd antenodal nervures; 8th nervure in the hindwing arising from the anal angle of the trigone; trigone in the hindwing at the arc or a shade distal to it; $10\frac{1}{2}$ to $12\frac{1}{2}$ antenodal nervures, the last incomplete; cubital nervures variable, either 1 in both wings or several; usually supplementary nervures to the bridge; trigone in the forewing broad, traversed, often several times, its relation to the hypertrigone rather more than a right angle; trigone in the hindwing traversed often several times, its outer side concave; hypertrigones variable, often traversed several times in the forewing, less so in the hind; 4th nervure flatly convex; 1 to 2 rows of cells between 5 and *5a*; 8th nervure in the hindwing strongly concave and therefore the discoidal field at the termen widely dilated; 3 to 4 rows of discoidal cells; anal field of the hindwing broad, with a long loop whose midrib is nearly straight and the outer angle very obtuse and with or without split cells. The cells between the base and the loop distinctly arranged in rows. Stigma large. Membrane medium sized.

27. Palpopleura sexmaculata, Brauer.

Libellula sexmaculata, Fabricius, Rambur, Neur, 1842, Burmeister.

Expanse 40 mm. Length 23 mm.

Male: head; eyes brown above, olivaceous at sides and beneath; vesicle and upper part of epistome and frons a brilliant metallic green; lower part of epistome, labrum and labium a pale yellow; occiput olivaceous.

Prothorax ochreous with brown borders.

Thorax a warm brown on dorsum, bordered outwardly by a black, irregular, humeral line; the sides a pale greeny yellow, almost white and bearing two black lines, the anterior incomplete above and approximating obliquely towards the posterior.

Abdomen a pale sky blue, the sides of first two segments pale yellow and the dorsum of the first brownish.

Wings short and comparatively broad, hyaline and saffronated palely as far out as stigma where this colour is deepest; a postnodal, costal spot in the forewing covering 1 to 2 cells, a dark streak in the postcostal space extending more than half way to the node and often overlapping, outwardly into the anterior costal space; a black spot lying between the sectors of the arc and an irregular triangular spot at the base occupying the cubital space and anal triangle posterior to it and about half of the proximal part of trigone. Stigma very large, black with a bluish middle. The black markings vary considerably in opposite wings and in individual species. Legs brownish, tibiæ yellow on extensor surface.

Female: head similar to male but vesicle and frons are brown, not metallic. Prothorax and thorax similar to male.

Abdomen ochreous, this colour deepest and richest along the sides; a fine middorsal line, broadening posteriorly, a broad subdorsal stripe, the intersegmental joints and the borders finely, black.

Wings very similar to those of the male but the hind deeply saffronated as far out as apex and the fore at the base and about the postnodal spot.

The black markings more extensive and extending on to hypertrigone in both wings.

Hab. Shillong, Pusa, Ceylon, Malabar, usually a very local insect.

Genus—BRACHYDIPLAX.

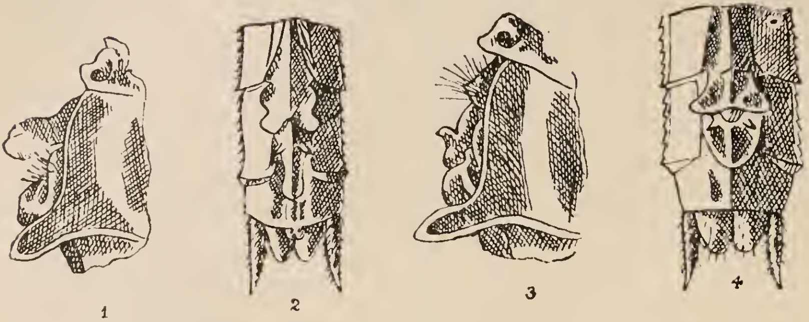


Fig. 30.—*a.* Male sexual organs of *B. sobrina*. *b.* Female sexual organs of same. *c.* Male sexual organs of *B. farinosa*. *d.* Female sexual organs of same.

Brachydiplax, Brauer, 1868.
Microthemis, Brauer, Kirby.

Head small or moderately large; eyes moderately contiguous; forehead narrow, somewhat prominent, the foreborder a little rounded; suture rather shallow; vesicle very small, rounded.

Prothorax variable, the lobe small or large, angulated and projecting outward. Either notched or entire, furnished with a ruff of long hairs.

Thorax moderately robust.

Legs long and slim. Male: hind femora with not very numerous, widely spaced spines of uniform size and length or nearly so, the mid femora with less numerous spines and a long one at the distal end; tibial spines numerous. slim and tolerably short; claw-hooks small, situated near the apex.

Abdomen at the base, slightly to strongly dilated, then tapering gradually to the end, short or relatively long. No transverse ridge on the 4th segment. Superior anal appendages with a marked angulation beneath in the male, slim.

Wings long, moderately narrow; reticulation very open; trigone in the forewing broad, in line with the trigone of the hindwing; relation of the trigone in the forewing to hypertrigone about a right angle; sectors of arc in both wings fused; arc between the 1st and 2nd antenodal nervures; 8th nervure in the hindwing arising from the anal angle of the trigone; 6 to 9 antenodal nervures, the final complete; trigone in the hindwing a little distal to the arc; 1 cubital nervure to all wings; all trigones and hypertrigones entire; subtrigone in the forewing 1 to 3 cells; no supplementary nervures to the bridge; 4th nervure without any perceptible undulation or with only a slight costalwards convexity; 1 row of cells between 5 and *5a*; 2 rows of cells in the discoidal field, the latter dilated at the termen; 8th nervure strongly curved; loop with a broad, outer angle, apex broad and blunt, the cells between its inner border and the base of the wing distinctly arranged in transverse rows. Stigma either medium sized or small. Membrane moderately large.

KEY TO SPECIES.

A. Lamina of the male sexual organs large. Antenodal nervures 7 .... *B. sobrina.*
B. Lamina of the male sexual organs small. Antenodal nervures 8 to 9 .... *B. farinosa.*

28. Brachydiplax sobrina, Ris, Kirby.

Libellula sobrina, Rambur.
Diplax sobrina, Brauer.
Sympetrum sobrina, Kirby.

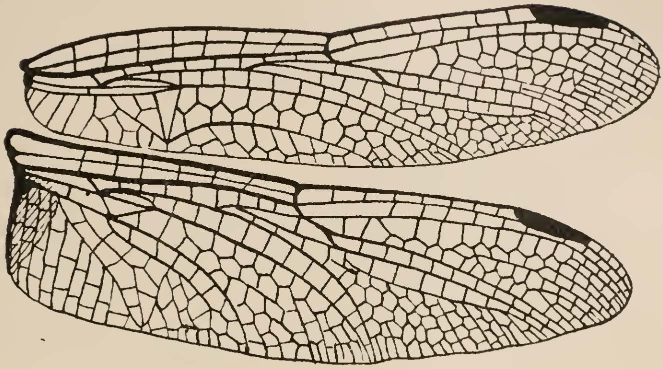


Fig. 31.—Wing neuration of *B. sobrina.* (× 2½).

Expanse, male, 50 mm., female 52 mm.
Length, male, 32 mm., female 28 mm.

Head; male; eyes moderately contiguous, a pale violet brown above, pale olivaceous at the sides and beneath; occiput black with two yellow spots posteriorly; front and upper part of epistome metallic bluish green, the lower part of latter, the labrum and labium, pale green; suture moderately shallow.

Prothorax black frosted with blue.

Thorax metallic green, frosted thickly with blue on the dorsum and the humeral region, thinly at the sides where the metallic green shows through and is marked by a post-humeral and a mid-lateral spot, yellow. The metepimeron broadly yellow crossed by a metallic green vertical stripe. Beneath frosted thickly with blue.

Abdomen frosted densely with bright blue, except the last 3 or 4 segments, a subdorsal, yellow spot on the 7th segment.

Anal appendages black.

Legs black frosted with blue.

Wings hyaline with a faint brownish suffusion near the membrane. Stigma a light brown, heavily bordered with black. Membrane white with a black bordering. 3 cells in the subtrigone.

Genital organs as shewn. Lamina large.

Female; head as for male.

Prothorax black, a collar in front, 2 spots on the mid-dorsum and the free margin of the lobe, lemon yellow.

Thorax metallic green in front with yellow markings and a bright yellow at the sides with metallic green markings. An irregular ?-shaped mark on the upper, and a similar coloured stripe on the lower humeral region. A Y-shaped mark and a broad stripe behind it, on the sides, metallic green.

Legs black, the base of the anterior femoræ yellow.

Abdomen broad at the base and gradually tapering from thence to the end. Strongly carinated, short. Black with yellow markings on all segments

except the 8th, 9th and 10th. A broad, conical, subdorsal spot with the base at the proximal end of the segments, which gradually diminish in size as traced back. A pair of spots on each segment on the ventral surface.
Anal appendages black.

Wings hyaline. Amber tinted rays in the hindwing in the inferior costal space as far as the 1st antenodal nervure and in the cubital space as far as the cubital nervure, posteriorly to which it slopes rapidly towards the membrane; subtrigone formed of 2 cells, the traversing nervure strongly curved; 7 antenodal nervures; stigma and membrane as for the male.

Hab. The borders of weedy tanks. Bombay, Calcutta, Malabar, Ceylon, Lower Burma.

29. Brachydiplax farinosa, Ris.

Brachydiplax sobrina, Selys.
Brachydiplax pruinosa, Laidlaw.

Male and female; expanse 46 mm., length 28 mm.

A rather smaller but very similar species to the last and distinguished from it chiefly by the small size of the lamina and the greater number of antenodal nervures.

Head similar to *sobrina*, the vesicle and upper part of forehead blue metallic. Prothorax and thorax of male green metallic, frosted with blue, densely in front and on the tergum, thinly at the sides. No markings.

The female a black metallic green with a variable number of small, yellow spots on the sides.

Abdomen narrow, depressed and tapering, in the male, frosted brightly with blue in the first 6 or 7 segments and black in the remainder; in the female black, no frosting, the 3rd, 4th and 5th segments with small, lateral, yellow spots which are obsolete in adult specimens. A small yellow spot on the 6th and a rather larger spot on the 7th segment.

Wings hyaline, relatively long to the abdomen; antenodal nervures 8 to 9; base of hindwing hyaline or a bright amber suffusion as far out as the cubital nervure. Legs as for *sobrina*.

Genital organs as shown.
Hab. Burma, Bhamo.

Genus—Acisoma.

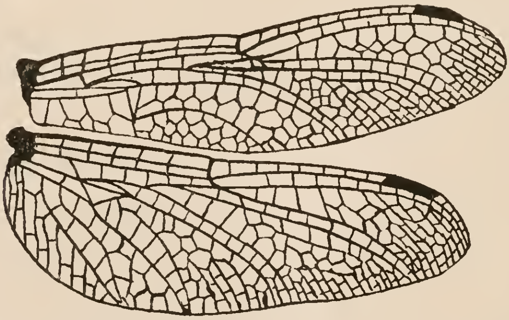


Fig. 32.—Wing neuration of *Acisoma panorpoides panorpoides* (× 2½).

Acisoma, Rambur.

Head rather small; eyes just touching; forehead rounded; mid-suture flush; vesicle small, rounded and depressed.

Prothorax with a large, projecting lobe which is slightly notched in its free border and lined with a ruff of long hairs.

Thorax moderately large, narrow.

Legs: hind femora with a row of closely set, short spines of uniform length for two-thirds the length and with a long spine at the distal extremity; tibial spines long, moderately robust and numerous; claw-hooks robust.

Wings short but moderately broad; reticulation fairly close; trigone in the forewing in line with that of the hind; sectors of the arc fused for a long distance; arc between the 1st and 2nd antenodal nervures; 8th nervure widely separated from the anal angle of the trigone in the hindwing; 7 to 9 antenodal nervures, the final either complete or incomplete; trigone in the hindwing at the arc; 1 cubital nervure to all wings; no supplementary nervures; costal side of the trigone in the forewing often somewhat crooked, the distal bent portion shorter than the proximal; both trigones entire; subtrigone in the forewing with 1 to 3 cells; hypertrigones entire; 4th nervure very flatly curved; 1 row of cells between 5 and 5*a*; 8th nervure in the hindwing short and very strongly bent; discoidal field with 2 rows of cells, widely dilated at the termen; anal field in the hindwing very broad; loop with a right angled outer angle and split cells, between it and the anal border, rows of very long, thin cells, standing perpendicular to the termen. Membrane small. Stigma moderate sized.

Abdomen: both laterally and dorso-ventrally dilated from the 1st to the 6th segment, the final segments very slim.

Anal appendages as long as the 9th segment.

Genital organs: *See* species.

30. Acisoma panorpoides panorpoides, Rambur.

Head: eyes turquoise blue; occiput and vesicle black; clypeus and labrum pale blue; base of occiput narrowly black, this colour prolonged into the suture and laterally on to epistome. A fine black line crossing epistome.

Prothorax-brown or black with 2 medium spots and the free edge of the lobe broadly sky-blue.

Thorax sky blue in the male, a fine yellowish green in the female, marked in both sexes with a variable, reticulated pattern of black spots and anastomising stripes, which suggest hieroglyphic or sanskrit characters.

Legs black, striped outwardly with pale blue or yellowish green according to the sex.

Wings hyaline with a very faint, diffuse suffusion of yellow at the bases. Antecubital nervures 7 to 8, the final nearly always complete. Stigma very pale yellow, bordered with brown. Membrane grey white at the base.

Abdomen sky blue in the male, yellowish green in the female, marked with black in both sexes as follows:—a chain of wedge-shaped spots on the mid-dorsum, the bases of the wedges being distal and the series steadily increasing in size as traced backwards; a chain of subdorsal spots from the 1st to the 5th segment, rather obscure on the first 2 segments; a broad black stripe on the first segment, notched posteriorly and the borders of the 4th and 5th narrowly black. The final 3 segments entirely black.

Anal appendages very pale blue or bluish green.

Genital organs; lamina of male procumbent; tentaculæ projecting; lobe very small but prominent. Vulvar scales of female projecting; the final abdominal segments markedly dilated and flattened dorso-ventrally.

Hab. All India, Ceylon, Burma, Straits, Bengal and Bombay.

Genus—SYMPETRUM.

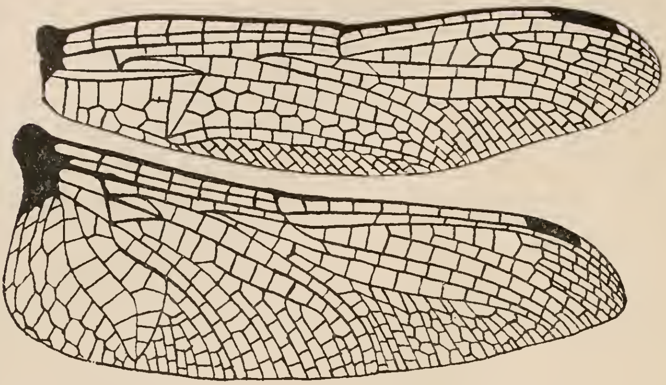


Fig. 33.—Wing neuration of *Sympetrum* (×$2\frac{1}{2}$).

Sympetrum, Newman. 1833.

Head slightly variable in size and shape, moderately small or occasionally proportionately large; eyes moderately contiguous; forehead a little prominent, rounded and with no marked foreborder: suture usually flush; vesicle moderately small, often very slightly notched.

Lobe of prothorax very large, projecting, divided by a deep notch into two lobes and bordered with a ruff of long hairs.

Thorax moderately robust.

Legs moderately long and slim, their armature in both sexes similar; the hind femora with a row of numerous, small spines and with a few longer ones at the distal ends; mid femora somewhat similar but the spines a little longer; tibial spines moderately short, fine, numerous; claw-hooks slim and long, situated about the middle of the claws.

Wings relatively short and broad, generally hyaline; reticulation fairly close; trigone in the forewing in line with that of the hind; sectors of the arc in both fore and hind-wings fused for a long distance; arc between the 1st and 2nd antenodal nervures; 8th nervure in the hindwing arising from the anal angle of the trigone; antenodal nervures $7\frac{1}{2}$ to $9\frac{1}{2}$, the final incomplete; 4th nervure with a single, flat curve or nearly straight; 1 row of cells between 5 and *5a* (2 rows in occasional specimens); 1 cubital nervure to all wings; no supplementary nervures to the bridge; trigone in the forewing relatively broad, the costal side at least half as long as the proximal, traversed; trigone in the hindwing entire (occasionally traversed); all hypertrigones entire; 8th nervure in the hindwing flatly convex, nearly straight towards the end; the discoidal field strongly contracted at the termen, beginning with 3 rows of cells (occasional specimens with the discoidal field of uniform breadth as far as termen and with only 2 rows of cells as far as the node); anal field of hindwing broad, no definite arrangement of cells in rows between the base and loop; loop well developed its outer angle obtuse, split cells at the outer angle and at the anal angle of the trigone ; membrane of medium size ; stigma small.

Genital organs of the male ; lamina usually procumbent; tentaculate strongly differentiated, the segments well divided ; the lobe comparatively small.

Genital organs of the female ; the border of the 8th abdominal segment curling outwards, not dilated ; end of the 8th ventral plate variable, small or very large, entire or notched, projecting or procumbent; 9th ventral plate occasionally with 2 hooklets near the middle, the border rather flatly rounded.

KEY TO SPECIES.

A. Comparatively small species.
Antenodal nervures numbering 6½ to 7½.
- *a.* Thorax dull red in front and above, bright lemon yellow at the sides.
  Basal line to forehead interrupted outwardly. Legs black, striped with yellow............................ *Striolatum.*
- *b.* Thorax sandy yellow.
  Basal line to forehead almost obsolete.
  Legs a sandy yellow................... *Decoloratum.*
- *c.* Thorax reddish yellow above and in front, greenish yellow laterally.
  Basal line to forehead broad and sharply defined...................... *Fonscolombei.*
- *d.* Thorax black, marked with bright yellow stripes laterally.
  Basal line to forehead black and diffuse. Legs black................. *Commixtum.*

B. Larger species with comparatively small head.
Antenodal nervures numbering 8½ to 9½.
- *a.* Thorax dull reddish yellow, with a narrow, black, humeral line.
  Antenodal nervures 8½.
  Wings hyaline, with a well-marked, basal, yellow spot................... *Orientale.*
- *b.* Thorax black, with 2 yellow stripes laterally.
  Antenodal nervures 9½. **(Nervurs black).**
  Whole of wing somewhat smoky, with a diffuse yellow spot at base..... *Hypomelas.*

31. Sympetrum striolatum, Meyer-Dur.
Libellula vulgata, Vander Linden.
Libellula striolata, Charpentier.
Sympetrum vulgatum, Linne.
Diplax striolata, Brauer.
Diplax vulgata race *striolata,* Schoch.
Libellula ruficollis, Charpentier.
Libellula secula, Hagen.
Libellula macrocephala, Selys.

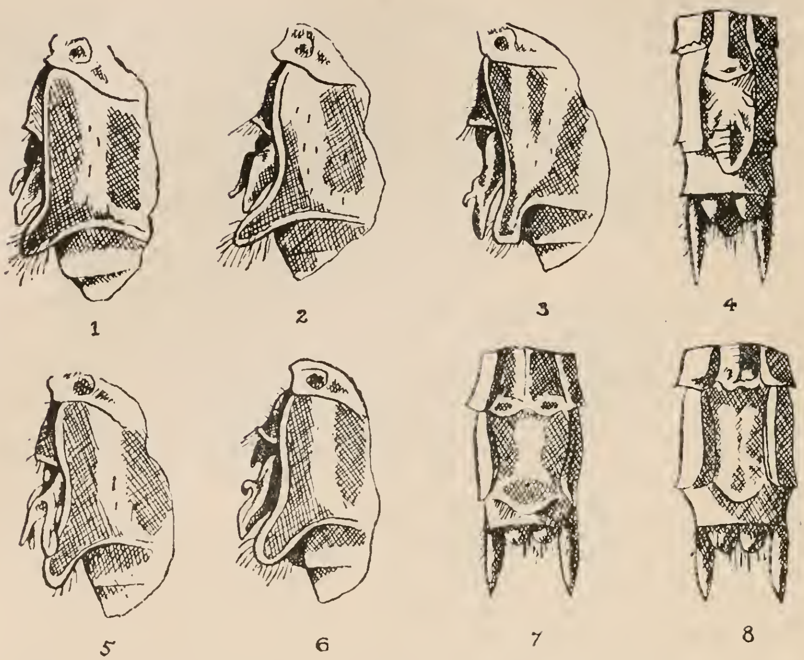


Fig. 34.—Male genital organs of :—

a. Sympetrum decoloratum, b. Fonscolombei, c. Hypomelas, e. Commixtum, f. Orientale.

Female genital organs of :—

d. Sympetrum decoloratum, g. Orientale, h. Hypomelas.

Expanse 58 mm. Length 38 mm.

Head ; eyes reddish brown above, puce coloured at the sides and beneath ; occiput, vesicle and epistome olivaceous brown ; forehead with a black, basal line broken at the eyes.

Prothorax reddish brown, the lobe very large and bordered with a fringe of long hairs.

Thorax dull red with a diffuse, dark green, humeral stripe. The sides of the thorax as far as the spiracle and the ventral border of the metepimeron a bright lemon yellow, dull greenish above, the area between being red.

Legs ; the extensor sides of legs black, striped with yellow, the flexor surfaces entirely black.

Wings hyaline or in very adult specimens, a little smoky ; a small basal marking, yellow with diffuse margins ; stigma reddish ; antenodal nervures 7½ ; 1 row of cells between 5 and 5*a*.

Abdomen slightly constricted at the 3rd segment and thereafter a little fusiformly dilated to the end ; reddish yellow with yellow annules at the intersegmental nodes.

Female very similar but of a duller hue, greyish or olivaceous brown more or less chequered or suffused with red. Markings as for male but more distinct. The abdomen bordered narrowly with black.

Genital organs of the male; internal segmenta of the tentaculae rather longer than the external, narrow, nearly straight but bent in its outer part and tipped with black. The internal tentaculæ often crossing each other at the middle line; lamina depressed; lobe small.

Genital organs of female; a prominent vulvar scale projecting at an angle of 60° ; border of 8th abdominal segment not dilated.

Hab. N. W. India, Quetta.

32. Sympetrum docoloratum, Ris.

Diplax vulgata race *decolorata*, Selys.
Sympetrum vulgatum race *decoloratum*, Selys.
Sympetrum decolorata, Morton.
Expanse 56 mm. Length 36 mm.

Head; eyes reddish above, ochreous at the sides and beneath; forehead yellow often with a tinge of red, its black basal line reduced to a mere point at the outer side of the vesicle; vesicle ochreous; occiput olivaceous; labrum and labium pale yellow.

Prothorax ochreous or pale yellow, the border of the lobe being finely black and furnished with a fringe of long hairs.

Thorax sandy yellow, the markings either obsolute or very obscure or occasionally a triangular, black mark on the mid-dorsum and a slender black streak on the side; beneath bright yellow.

Legs entirely yellow or the flexor sides of femora in their distal halves, black.

Wings hyaline, the reticulation at the base and along costa bright yellow; stigma reddish yellow with heavy black bordering, 2·5mm.; antenodal nervures 6½; no basal marking to the wings as a rule.

Abdomen bright reddish orange with, in many specimens, a bright yellow spot situated subdorsally near the distal end of each segment.

Anal appendages reddish.

Genital organs of male; lamina procumbent; tentaculæ very small, yellow and pointed with black; the internal tentaculæ narrower and less sharply curved than in *striolatum*.

Genital organs of female; a large vulvar scale projecting vertically.

Hab. Continental India in the drier zones, Quetta, the Deccan.

33. Sympetrum fonscolombei, Selys, Meyer-Dur.

Libellula flaveola, Fonscolombei.
Diplax fonscolombei, Meyer-Dur.
Libellula fonscolombei, Selys.
Libellula erythroneura, Buchecker.
Sympetrum rhœticum, Buchecker.
Sympetrum sanguineum, Longstaff.
Expanse 60 mm. Length 38 mm.

Head; eyes reddish brown above, paling to a peach blossom or lilaceous tint at the sides and beneath; occiput brown; vesicle reddish brown; front brown or reddish brown above, white below, a broad black basal line at the vesicle and eyes; labrum and labium brown.

Prothorax ferruginous, furnished with a ruff of very long hairs.

Thorax small, narrow, reddish brown above on dorsum, a greenish blue tint laterally where it is traversed by 3 oblique, black stripes, the middle one of which lies interior to spiracle and is interrupted or incomplete above; beneath marked with black frosted over with white.

Legs almost entirely yellow, the hind tibiæ alone being black on their extensor surfaces.

Wings hyaline, the reticulation in the basal half of male being a bright red, in the female a reddish yellow; an amber coloured marking at the base of both wings, in the forewing but slightly marked in the superior costal space and as far as the 1st antenodal nervure in the inferior costal space, slightly in the subcostal space and as far as the cubital nervure in the cubital space ; in the hindwing the marking reaching beyond the 1st antenodal nervure and cubital nervure and extending for a variable distance over the anal triangle. Trigone in the forewing traversed, in the hind entire ; antenodal nervures 6½ ; stigma pale brown or yellow, bordered at the costa broadly with brown, 2—2·5 mm. ; membrane fairly large, white.

Abdomen cylindrical, sides parallel, but a slight constriction at the 3rd segment, bright red on the dorsum, laterally greenish yellow, marked with 2 parallel black lines and on the 8th and 9th segments a pyriform black spot. Anal appendages nearly as long as the 9th segment, reddish.

Female somewhat similar to the male but the reddish tinting not so marked. The forehead and labrum a bright yellow, the space between white or diaphanous ; the thorax a light golden brown and laterally greenish yellow with the same black markings as in the male ; abdomen a light brownish yellow with black marks similar to those seen in the male.

Genital organs of the male ; tentaculæ very small, the internal segment being strongly curved ; lamina procumbent ; lobe small.

Genital organs of female ; vulvar scale very small, projecting but very slightly.

This and the preceding species are often the carriers of minute Acari, which parasytise them from the water and which utilises them not so much for a living as for a distributing agent. There is no evidence to show that they draw any sustenance from their hosts.

Hab. Throughout Europe, Asia Minor, Central and Southern Asia, Quetta, Kashmir 5—10,000′. Murree, Nilgiris 7,500.'

34. **Sympetrum commixtum**, Kirby.

Diplax commixta, Selys.
Sympetrum subpruinosum, Kirby.
Expanse 60 mm. Length 38 mm.

Head relatively large and somewhat globular ; eyes reddish brown above, violaceous or puce coloured at the sides and beneath ; the forehead narrow and marked at the base with a diffuse black stripe ; vesicle brown ; occiput olivaceous brown ; face and labrum yellow.

Prothorax yellowish brown.

Thorax dorsally and in front a brownish yellow, laterally black with 2 bright yellow bands which deepen in colour as traced towards the dorsum ; beneath variably black.

Legs entirely black, the outer surface of anterior femora often striped with yellow.

Wings hyaline with the apices occasionally smoky ; antenodal nervures 6½ ; discoidal field much contracted at the termen ; 1 row of cells between 5 and 5*a* ; the basal marking a pale, diffuse yellow ; stigma ochreous, 3 mm.

Abdomen in the male a little fusiform, red above, deep black beneath, which latter colour overlaps the lateral borders of the dorsum.

Anal appendages reddish or ochreous.

Female very similar to the male but of a much duller hue and without any of the red colouring of the male.

Genital organs very similar to *striolatum*.

Hab. Throughout Continental India, the Deccan, Deesa, N. W. India.

35. **Sympetrum hypomelas**, Kirby.

Diplax hypomelas, Selys.
Expanse 66 mm. Length 36 mm.

Head comparatively small; eyes brown above, paler laterally and beneath; occiput and vesicle brown; front, epistome and labrum yellowish; basal line of forehead usually present.

Prothorax brownish yellow.

Thorax brown with 2 broad, bright yellow, lateral stripes somewhat darker above, a broad dark humeral band and black stripes traversing the spiracle and metepimeron.

Legs entirely black except the flexor surfaces of the hind femora.

Wings hyaline or suffused with a smoky, yellow tint. Antenodal nervures 9½; the discoidal field barely contracted at the termen; a variable yellow mark at the base of hindwing.

Abdomen of male strongly constricted at the 3rd segment and fusiformly dilated from the 6th to the 9th, the dorsal surface red, the ventral black. The lateral borders often finely black.

Anal appendages reddish.

Genital organs of male; tentaculæ very large, black, the external segment directed nearly horizontally back, the internal shaped as a robust, strongly curved hook; lamina procumbent; lobe small, rectangular and directed strongly backward.

Genital organs of female; vulvar scale very small.

Hab. Bengal, Assam, Khasia Hills, Burma, Thibet, Sikhim.

36. **Sympetrum orientale**, Kirby.

Diplax orientale, Selys.

Expanse 56 mm. Length 33 mm.

Head comparatively small; eyes brown above, paler at sides and beneath; vesicle and occiput brown; forehead with a diffuse basal line present as a rule; front and epistome pale yellow.

Prothorax brownish.

Thorax reddish brown on the front and dorsum, a dull reddish yellow on the sides, a narrow, black humeral stripe, other markings very obscure.

Legs entirely black or the hind femora striped with yellow on the flexor surfaces.

Wings hyaline; discoidal field barely contracted at the termen; basal spot to hindwing moderately large, a golden yellow colour with the free border not sharply defined; antenodal nervures 8½.

Abdomen similar in shape to *hypomelas*, brick red on the dorsum, black ventrally.

Genital organs of male; tentaculæ moderately large and projecting nearly horizontally, the internal segment being strongly curved; lamina moderately flat but more prominent than in *hypomelas*; lobe a little rounded slightly arched, small.

Genital organs of female; a very small vulvar scale, 2 flatly curved projections from the 8th ventral plate.

Hab. Bengal and Assam, Khasia Hills.

The *Sympetra* are a group of very similar insects, whose specific differences are not very marked, whose colouring is very similar and whose markings are usually very obscure. The first four species are very closely related to one another and a good deal of confusion has marked the history of their specific valuation. *Hypomelas* and *orientale* are sharply marked off from the rest and may be distinguished from one another by a comparison of their genital organs. They are more closely related to each other than to the first four species of the group.

Genus—Diplacodes.

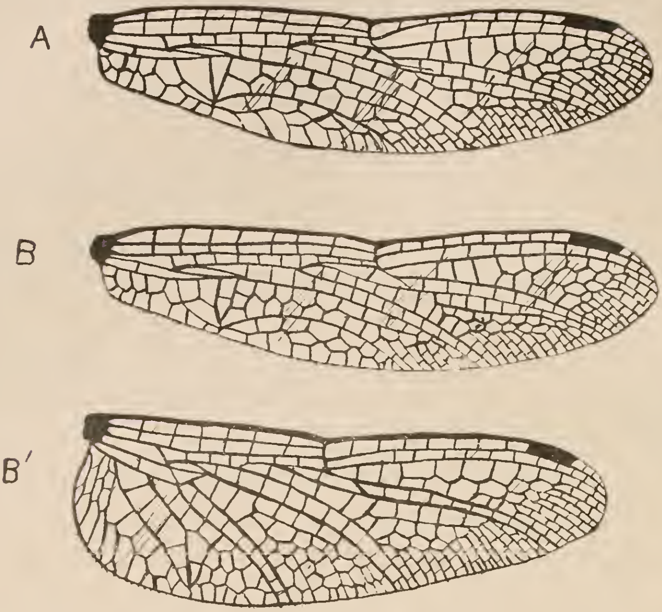


Fig. 35.—*A.* Forewing of *Diplacodes nebulosa.*
B. Forewing of *Diplacodes trivialis* contrasting its neuration with that of "A".
B. Hindwing of *Diplacodes trivialis.*

Diplacodes, Brauer 1868, Selys 1883, Karsch 1889, Kirby and Ris.
Trithemis, Kirby.
Diplax, Brauer.
Libellula, Fabricius, 1793, Rambur 1842.

Head very small; eyes just meeting; forehead moderately prominent, rounded and without a marked foreborder; suture moderately deep; vesicle rounded.

Prothorax: posterior lobe moderate to very large, projecting in the middle, slightly or thickly fringed with long hairs according to the species.

Thorax comparatively narrow.

Legs moderately robust; middle and hind femora with a row of not very closely set but usually long spines, (Armature of legs in the two sexes scarcely differing), tibial spines fine, numerous; claw-hooks robust, situated about the middle of the claws, sloping.

Wings relatively short and broad, reticulation moderately close. Trigone in forewing slightly distal to that of the hind; sectors of arc in forewing, shortly fused, a long fusion in the hind; arc between the 1st and 2nd antenodal nervures; 8th nervure in the forewing strongly arched, in the hindwing separated (usually widely so) from the anal angle of the trigone; antenodal nervures usually 7½, but variable, the final incomplete; trigone in the hindwing at the arc; only 1 cubital nervure to all wings; no supplementary nervures to the bridge; trigone in the forewing free or traversed, in the hind entire; 4th nervure flatly arched; 1 row of cells between 5 and *5a*; discoidal field with

2 rows of cells in its proximal part or 1 row of 3 cells at the trigone, followed by rows of 2, strongly dilated at the termen; anal field of hindwing broad, 2—3 rows of cells between the inner border of the loop and the basal margin of wing; loop with a right-angled outer angle and with bifurcated cells.

Membrane and stigma of medium size.

Abdomen slim and nearly cylindrical in both sexes, dilated at the base and dorso-ventrally in the distal half of the 7th and for the whole of the 8th and 9th.

Sexual organs: For those of the male see under species.

Of the female; border of 8th segment not dilated; 8th ventral plate at its end prolonged into a projecting and somewhat bipartite, vulvar scale; 9th ventral plate flat at the base or slightly keeled and furnished with small hooks, the apical half usually somewhat bent ventralwards and the end prolonged as a tongue-like projection overlapping the 10th segment.

KEY TO SPECIES.

A. Trigone in the forewing free.
  Subtrigone in the forewing free, (rarely formed of 3 cells.)
  Discoidal field with 2 rows of cells at its commencement .... *D. nebulosa.*
B. Trigone in the forewing traversed, (rarely one or both free.)
  Subtrigone in the forewing formed of 3 cells.
  Discoidal field commencing with 3 cells and then continued as 2 rows of cells (rarely commencing with 2 cells).................. *D. trivialis.*

37. **Diplacodes nebulosa,** Kirby, Trans. Zoo. Soc. Lond. 12, p. 308. (1889).
Karsch and Selys.
Kirby, *Cat. p.* 42, 1890.
Id., *Linn. Soc. Journ. Zool,* 24. *p.* 556, 1893.
Diplax nebulosa, Brauer, *Zool. bot. Wein.* 18. *p.* 721, 1868.
Selys. *Ann. Soc. Ent. Belg.* 27 *p.* 96. 1883.
Libellula nebulosa, Fabr. *Ent. sys.* 2 *p.* 379, (1793).
Hagen. *Zool bot. Wien.* 8 *p.* 481. 1858.
Expanse 42 mm. Length 24 mm.

Male: in adults and usually in moderately juvenile specimens, the whole of the thorax and abdomen is black, frosted finely with blue and the markings almost or entirely obsolete. The head black, the forehead and upper part of epistome being highly glazed and of a bluish lustre. The labrum brownish; the eyes deep sea blue, paler beneath. Legs black.

Juvenile specimens: head; forehead, epistome, labrum and labium pale yellow; a fine dark line to forehead in front of the vesicle which is bright yellow; occiput bright yellow; eyes pale blue beneath, brownish above.

Prothorax pale yellow, the brown humeral band of the thorax continued on to it.

Thorax; dorsum broadly black, 2 yellow spots at the wing attachments, a narrow, diffuse, humeral band which uniting with the mid-dorsal dark area, encloses a variably sized spot of yellow. The sides bright yellow, the sutures mapped out in black, an interrupted black line over the spiracle, the metepimeron variably black. Often there is a very variable marbling of brown on the sides.

Legs yellow, black on the flexor surfaces.

Wings hyaline with dark brown tips, this colour extending inwards as far as the inner end of the stigma and with the inner margin extending back almost straight to the termen. The apical marking differs according to the age of the specimens and in some very juvenile specimens sent to me by Mr. Bainbrigge Fletcher from Pusa, it is entirely absent or if present is a mere shadow. Stigma dark brown, 2 mm. A small tinge of brown at the base of the hindwing extending out as far as the cubital nervure.

Abdomen black marked with pale yellow; segments 2 and 3 with broad yellow spots on the sides which often almost entirely obscure the ground colouring. Subdorsal spots on the 4th to 7th segments which gradually decrease in size as traced distally. Last 3 segments entirely black.

Anal appendages pale yellow or ashy.

Female very similar to juvenile males but brighter coloured. The black markings of the thorax obscure, the yellow markings of the abdomen preponderating over the black which is present only as fine annules at the intersegmental joints and a narrow black line along the mid-dorsal carina. A fine black line along the ventro-lateral ridge. The 9th and 10th segments black or small, yellow, subdorsal spots on the 9th. Anal appendages bright yellow.

Wings hyaline, the basal spot bright saffron, the stigma pale brown. The apical brown markings seen in the male, quite absent in the female.

Hab. Eastern and Central India, Ceylon, Bengal, Madras and Burma extending thence to the Straits, Malacca, Singapore, Java.

This species is found only in marshy areas, being rarely if ever seen away from the neighbourhood of water.

A well marked variety is found in Mesopotamia and Mr. Rishworth has sent me similar specimens from Karachi. In these the apical marking is usually obsolete and if present is a mere shadow. There is also a well-marked blackish brown basal spot reaching more than half way to the first antenodal, beyond the cubital nervure and thence obliquely to nearly as far as tornus. " This variety may be the *D. parvula* of Rambur but as I have seen no specimens of the latter, I cannot say for certain. "

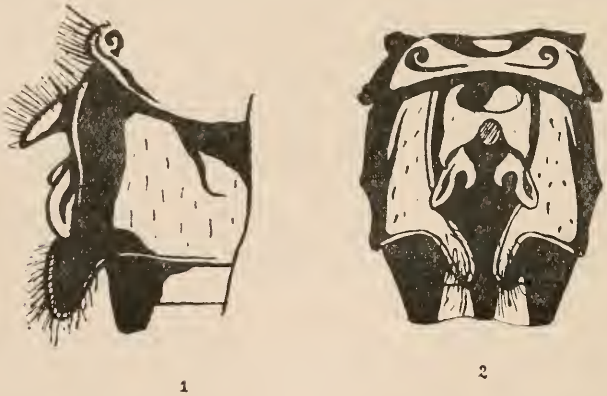


Fig. 36.—Male sexual organs of *D. trivialis*, (× 18).

1. In profile. 2. From the front.

38. Diplacodes trivialis, Karsch, *Ent. Nach.* 17, *p.* 246. (1891). *Sumatra.*
Kirby, *Ann. Mag. Nat. Hist.* (7). 15. *p.* 271. (1905).
Libellula braminea, Fabr. *Suppl. Ent. Syst. p.* 284. (1798).
Libellula trivialis, Ramb. *Neor. p.* 115. 1842.
Diplax trivialis, Brauer. *Novara. p.* 104, 1866. *Batavia.*
Id., *Zool. bot. Wien.* 17, *p.* 289, 1867. New Guinea.
Trithemis trivialis, Kirby. *Trans. Zool. Soc. Lond.* 12, *p.* 278. (1889).
Id. *Cat. p.* 18, 1890.
Expanse 45 mm. Length 26 mm.

Male and female very similar.

Head; eyes very pale blue, capped above with a small greenish zone which shows brown in certain lights; vesicle pale blue or tinged with yellowish green; occiput brown; forehead, epistome, labrum and labium very pale blue. A black, basal line to the forehead in front of the vesicle.

Prothorax pale greenish yellow with the humeral stripe of the thorax continued on to it.

Thorax the same colour but fading to pale blue on the sides and almost to white on the underneath. A brownish humeral stripe, finely bordered on the inner and outer sides with black. Laterally, the sutures finely mapped out in black and often a small black spot lying between them.

Legs greenish yellow, the femoræ ringed with black at the distal ends; flexor surfaces of the tibiæ black.

Wings hyaline, with a small basal, saffronated spot in the hind wings, more noticeable in the female and extending out as far as the cubital nervure, not quite to the inner border of the loop and about half-way or less to the tornus; 7½ antecubital nervures; stigma pale brown; membrane grey; costa yellow.

Abdomen black, marked variably with pale, greenish-yellow, the first 3 segments with broad spots on the sides which almost obscure the ground colour, the sutures on these 3 mapped out finely in black; long, narrow, oval spots on the 4th to 7th segments, the distal 3 entirely black. (In the female and juvenile males, these last 3 segments bear small, similar spots to those on the 4th to 7th). Beneath, pale blue.

Very adult specimens of the male tend to lose most or all of the yellow markings, the abdomen especially, being entirely black with a frosting of blue. In some specimens which I took on the Katraj Lake, Poona, the frosting extended over the whole of the thorax, legs and abdomen and the markings were entirely obsolete. In these specimens the eyes were a beautiful topaz blue and the stigma in all wings was a light azure blue.

Sexual organs of the male; lamina moderately large and projecting and split by a deep, broad, triangular cleft into 2 somewhat diverging lobes; external tentaculæ broadly triangular; internal small but robust and shaped as an outwardly bent hook. Lobe projecting rather more than the tentaculæ.

Anal appendages pale yellow.

D. trivialis is a species of the plains and usually frequents low, dry situations. Numbers may often be seen settling or hovering over roadsides and bye-paths or bare waste lands. It is comparatively rarely seen over water and then only at certain seasons when very adult specimens appear to betake themselves to the neighbourhood of lakes and tanks for purposes of breeding. In this respect it contrasts strikingly with *nebulosa* which is rarely seen away from water.

In Madras where both species are moderately common, the two are rarely taken in company.

Hab. The whole of Continental India except in the hilly regions. **Ceylon,** Singapore, Java, New Guinea, Lower Mesopotamia.

Genus—RHODOTHEMIS.

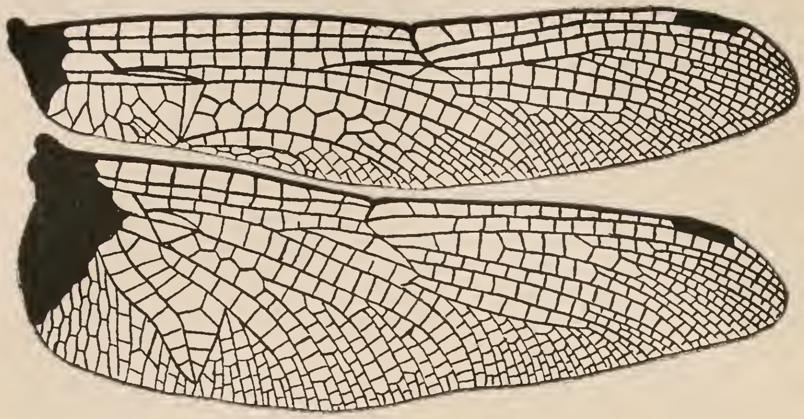


Fig. 37.—Wings, showing neuration of *Rhodothemis rufa.*

Rhodothemis, Ris, 1911.
Crocothemis, Van der Weele, Hagen.
Libellula, Rambur, 1842.
Erythemis, Brauer.
Orthetrum, Kirby.

Head of medium size; eyes just meeting; occiput large; forehead projecting moderately; in the male a shallow suture separating two flattened, triangular areas which are not so distinctly demarcated in the female; the suture almost flush. Vesicle broad at the base but narrowing or pointed above where it bifurcates into two tiny prominences.

Prothorax lobe large and projecting, divided into two rounded lobes which are fringed with long hairs.

Thorax robust. Legs very slim. In the male the hind pair of femora with about 8 very closely set and smallish spines, followed by 5 or 6 gradually lengthening ones; tibial spines numbering about 10, long and moderately stout. Armature in the female less open but the basal spines of the femora are wider set and less numerous. Claw-hooks small.

Wings long and moderately broad; reticulation fairly wide; trigone in the forewing a little distal to the line of the trigone of the hindwing; sectors of the arc in both wings with a long fusion; arc between the 1st and 2nd antenodal nervures; 8th nervure in the hindwing slightly separated from the anal angle of the trigone; antenodal nervures 10½ to 12½, the final incomplete; trigone in the hindwing at the arc; 1 cubital nervure to all wings; no supplementary nervures to the bridge; trigone in the forewing narrow, traversed; trigone in the hindwing and all hypertrigones free; subtrigone in the forewing with 3 cells; 4th nervure with a single flat curve; 1 row of cells between 5 and 5*a*; 8th nervure in the hindwing very strongly bent; the discoidal field beginning with 3 or 4 cells and then continued as 2 rows of cells nearly as far as the line of the proximal end of the bridge, strongly dilated at the termen; anal field of hindwing broad; the loop large, its outer angle extending 3 cells distal of the trigone, 4 rows of cells between it and the basal margin of wing. Membrane large. Stigma moderately large.

Abdomen at the base, dorso-ventrally dilated but only slightly so from side to side. Broad and depressed and tapering gradually to the end.

Sexual organs: see under species.

39. Rhodothemis rufa, Ris. 1911.
Crocothemis rufa, Van der Weele.
Erythemis rufa, Brauer.
Libellula rufa, Rambur.
Orthetrum oblitum, Kirby.
Erythemis oblita, Brauer.
Libellula oblita, Rambur, 1842.
Crocothemis cruentala, Hagen.
Expanse 72 mm. Length 44 mm.

Male : head; eyes bright red, capped at the summit with brown, paler beneath; forehead and upper part of epistome bright scarlet ; lower part of epistome and the labrum a rich ochreous or reddish ; labium brown ; occiput reddish brown.

Prothorax brownish red.

Thorax reddish brown with no markings.

Abdomen bright scarlet or vermillion red.

Anal appendages red.

Wings hyaline with a dark brown spot at the base of the hindwing which extends as far as the 1st antecubital nervure and well beyond the cubital nervure. Posteriorly this spot usually reaches the tornus. In the forewing the basal spot very small and not extending as far the 1st antenodal and cubital nervures.

Juvenile males are much lighter than the adults in colour and approach somewhat that of the female.

Female : Expanse 70 mm. Length 41 mm.

Head ; eyes reddish brown above, much paler beneath and at the sides ; vesicle brown ; occiput a pale greenish yellow ; forehead the same colour ; upper part of epistome black and very sharply defined from the forehead ; lower part of epistome and labrum ochreous.

Prothorax dark brown, with a pale greenish yellow, mid-dorsal stripe which widens posteriorly and is continuous with a similar coloured stripe on the thorax.

Thorax golden brown, the fore part darker. A mid-dorsal, greenish yellow stripe which runs back over the interalar space and is continued posteriorly with a similar coloured stripe on the fore part of the abdomen. In front, this band is split by the mid-dorsal carina into two narrow, triangular spots, and is bordered outwardly by a broad, black, humeral stripe.

Abdomen dark golden brown, with the greenish yellow dorsal band of the thorax continued on to it as far as the 4th segment and from thence represented by a pair of similar coloured spots on the fore part of each segment as far as the 8th or 9th. A fine, black, mid-dorsal line on the 1st to 4th segment.

Wings as for male but the basal spot paler and its margin diffuse. Stigma dark brown.

Sexual organs of male ; lamina broad and depressed, its free border curling outwards ; tentaculæ small, the internal a robust hook, straight at the base but curving outwards at the point ; the external narrow, somewhat square and of about the same length as the internal ; lobe very narrow and tongue-like.

Sexual organs of the female ; border of the 8th abdominal segment not dilated ; and of 8th ventral plate forming a strongly developed, broad, projecting vulvar scale which overlaps the 9th ventral plate ; the 9th narrow and projecting over the 10th and furnished with a small, conical protuberance on each side.

Hab. Western India as far North as Bombay, Ceylon. I have taken females of this species in considerable numbers in Bombay during the month of November but the males were extremely rare. On the wing, the adult male is indistinguishable from *O. pruinosum* or *C. servilia,* for both of which it is liable to be mistaken. The insect frequents rank jungle in the immediate neighbourhood of large tanks.

Genus—NEUROTHEMIS.

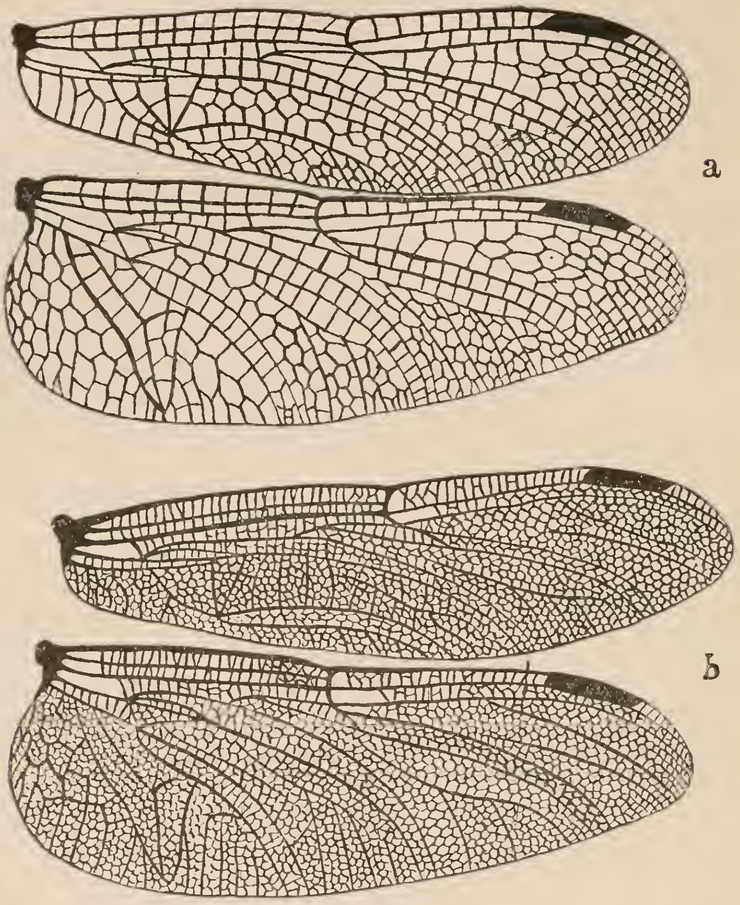


Fig. 38.—Wings of (*a*) *N. intermedia*, and (*b*) *N. fulvia*, contrasting the open and close reticulation of the neuration.

Head moderately large; eyes meeting for but a short distance: forehead rounded and but slightly prominent, in the male, with or without a distinct fore-border, in the female without: suture generally wide and shallow; vesicle markedly tumid and with two poorly-developed tubercles above.

Prothorax: lobe small and not projecting, notched slightly in the middle line.

Thorax medium sized; legs slim, very similar in the two sexes; femora 3 with 12 to 16 small, gradually lengthening spines; mid femora similar but fewer spines; tibial spines very slim, somewhat far apart; claws fine, the hooks situated about the middle.

Abdomen rather short, the base moderately, ventro-dorsally dilated, the dorsum markedly carinated, gradually tapering towards the anal end; 4th segment without a transverse ridge. Anal appendages small and acuminate.

Sexual organs in the male; lamina depressed, broadly and flatly arched, the free border fringed with longish hairs; external tentaculæ foliate, somewhat quadrangular, overlapping the lobe laterally; internal tentaculæ robust hooks curving first backwards and then outwards. Lobe rather higher than the tentaculæ, narrow and strongly arched.

Sexual organs of the female; border of 8th segment not dilated; 8th ventral plate prolonged as a rather large, oval, vulvar scale which projects almost at a right angle from the body axis; 9th ventral plate slightly carinated in the middle line.

Wings moderately broad, often differing in the two sexes, often coloured wholly or in part and often showing an extensive formation of secondary reticulation; trigone in the forewing 2 to 3 cells distal to the line of the trigone in the hind; sectors of the arc in forewing short, in the hind, a longer fusion; arc between the 1st and 2nd or at the 2nd antenodal nervure; 8th nervure in the hindwing at the anal angle of the trigone; antenodal nervures numerous, in the forewing 11½ to 36, the final incomplete, often a development of reticulation at the outermost antenodal nervures; base of trigone in the hindwing at the arc; 4th nervure moderately convex in the middle; normally 1 row of cells between 5 and *5a*, but owing to a development of secondary reticulation, this space is often filled with a close irregular network made up of several rows of cells; trigone in the forewing relatively short and broad, its relation to the hypertrigone rather more than a right angle, traversed by 1 or 2 main nervures and often filled with secondary nervures; trigone in the hindwing with a strongly concave, distal border, traversed once but often filled with a network of secondary reticulation as in the trigone of the forewing; cubital nervures generally multiple; supplementary nervures to the bridge either absent or if present numerous; 8th nervure strongly curved; discoidal field with 3 rows of cells or filled with a close reticulation; nearly parallel sided as far as the termen. Anal field of hindwing broad, loop with long and broad apex, the external angle obtuse, the midrib almost straight. The cells between the inner border of loop and basal margin of the wing, only indistinctly arranged in rows of largish cells which in one species are further divided up by secondary nervules, Membrane moderately large. Stigma moderate to very long.

The members of this genus show wide variation in their general facies and often very marked variation in the individuals of any one species.

In some species the sexual differences, especially in colouring are very pronounced. Six species are taken within Indian limits.

KEY TO SPECIES.

A. Numerous nervures traversing the space bounded in front and behind by the subcostal and 3rd nervures and laterally by the node and the proximal end of the bridge.
  i. Male; wings dark golden brown with reddish reticulation as far out as the stigma, the outer border of this marking strongly indented .... *N. fulvia.*

B. No nervures traversing the space bounded in front and behind by the subcostal and 3rd nervures and laterally by the node and the proximal end of the bridge.
  i. Male; base of wings up to the node in the forewing and distal to the node in the hind, black, iridiscent violet, bordered outwardly by a broad, white, opal band. Female; base of wings yellow as far as node, a fairly broad, irregular fascia traversing both wings at the node and the apices brown .... *N. tullia tullia.*

ii. Male; similar to former but without the opal band .... *N. tullia feralis.*

iii. Male; base of wings golden yellow in the forewing as far as 2 to 3 cells distal to trigone, to a more distal point in the hind. Female; apices of wings hyaline .... *N. intermedia, intermedia.*

iv. Male; base of wings yellow as far as 2 cells proximal of stigma. Female; apices of wings pale brown .... *N. intermedia degener.*

v. Male; basal marking up to the proximal end of stigma, (variable in extent). The marking in the hindwing curving inwards so as to reach the termen proximal to the terminal end of the 6th nervure. Female; variable. Wings hyaline or saffronated, basal mark in the hindwing very small and not reaching the trigone. Apices of wings tipped with brown .... *N. fluctuans.*

vi. Male; basal marking extending to stigma and its free border running straight back from costa to termen in both wings. Female; wings bright yellow, with a poorly marked, darker yellow spot at the base and a dark brown apex ...... *N. terminata.*

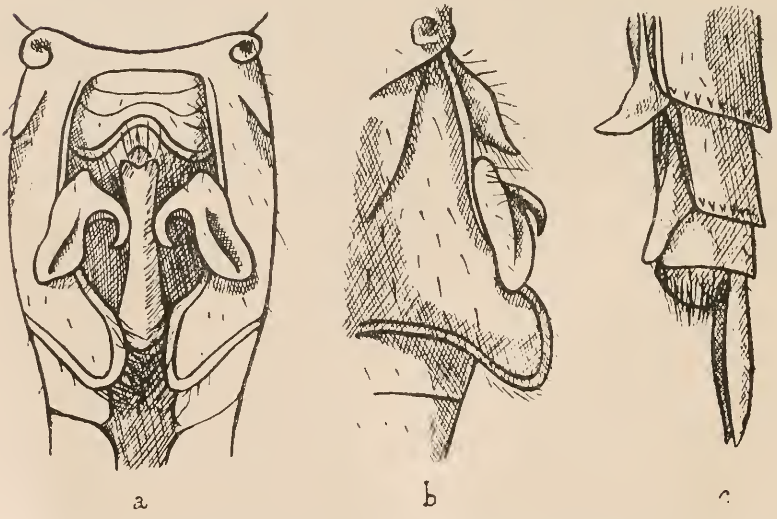


Fig. 39.—Sexual organs of *N. fulvia.* (*a*) of the male from the front, (*b*) of the male in profile, (*c*) of the female, (×20).

40. Neurothemis fulvia, Kirby.

Neurothemis sophronia, Brauer.
Libellula sophronia, Drury.
Libellula fulvia, Drury.
Polyneura sophronia, Rambur.
Polyneura fulvia, Rambur.
Libellula apicalis, Guerin.
Male; Expanse 68 mm. Length 40 mm.

Head moderately large, somewhat globular; eyes just meeting, reddish brown above, paler beneath; clypeus, labrum and labium ochreous; vesicle tumid and with two small points above, coated with short, stiff hairs; occiput large brown. Suture almost flush.

Prothorax brown, the lobe small, notched, naked.

Thorax coated with hair on the dorsum, laterally naked, golden brown in front and above, ochreous in the humeral region, bright olivaceous yellow laterally and beneath. Legs ochreous, femora spined as for genus.

Wings moderately broad, both coloured a rich, reddish brown tint throughout the whole of their extent, except for a small window near the apex, the limits of which are as follows:—In the forewing from the inner third of the stigma, in a very sinuous curve to the termen which it reaches at a point midway between the ends of the 5th and 6th nervures; in the hind from the same point but sloping back towards the base of the wing; outwardly this hyaline spot is bounded by the brown tip to the apex of the wing which begins variably from the outer end of the stigma. In both wings the inner margin of the spot is very deeply indented.

In addition to the colourless area, there are a number of hyaline spots or streaks where the ground colour instead of being smoky, is a clear, pale amber tint; these are the superior costal space, the subcostal space, the hypertrigone and the anal angle immediately adjacent to the membrane and also a small spot lying between the node and the inner postcostal nervure and a spot twice its size immediately in rear of it. The smoky ground tint is not always uniform and in many specimens the termen at the basal half of the wing especially in the hind, and the inferior costal space are of a much darker tint. Antenodal nervures numbering about 30 to 35 but these are extremely irregular, and are often forked or joined up in a close anastimosis. The stigma large, dark brown; the membrane grey. There is a great formation of secondary reticulation throughout the wings and the 3rd nervure is constantly forked at the inner end of the stigma; the supernumerary nervures to the bridge are about 8 and the cubital nervures number about 10 and 5 in the fore and hindwings respectively. The spaces between 5 and 5*a*, and 7 and 7*a* filled with a close reticulation.

Abdomen a little tumid at the base, especially dorso-ventrally, gradually tapering towards the anal end and markedly keeled on the dorsum. A rich, dark brown with the intersegmental nodes black. Anal appendages yellow, ochreous or brown.

Sexual organs as for genus.

Female: expanse and length as for male; shape very similar but the abdomen considerably shorter. The general colouring a much paler, golden yellow which on the sides of the thorax is distinctly olivaceous or greenish. The most marked differences seen in the wings, which are a rich, clear, golden yellow or amber tint marked with a deeper, smoky brown in those areas noted in the male where the tinting was intensified. The hyaline windows at the distal ends of the wings are absent or if present then only obscurely and diffusely so.

Sexual organs as for genus.

The sexual differences in this species are so marked that Rambur and Drury described the male and female as two distinct species, although the former suggested that they might be the two sexes of one species.

I have specimens from Calcutta, Bombay, Madras and Assam which show but the slightest differences in markings but in three males sent to me by Mr. Beeson, taken in Toungoo and Tharawaddy, Burma, these are so marked as to be almost specific. In these the ground colour approaches nearer to the female, being a rich, pale golden brown. The apices of the wings are but faintly tipped with pale amber and the margins of the hyaline area are not nearly so clearly cut.

This species is a shy, retiring insect, usually keeping to the precincts of dense jungle. Males and female are nearly always seen in company but very rarely pairing and although a comparatively common insect, I have never seen them over water or ovipositing.

Hab. India except in the desert or drier zones, Burma, Ceylon.

41. Neurothemis tullia tullia, Ris.
Libellula equestris, Fabricius.
Libellula lineata, Fabricius.
Diplax equestris, Brauer.
Libellula tullia, Drury.
Neurothemis equestris, Brauer.
Neurothemis var. pedestris, Selys.

Male : Expanse 45 to 53 mm. Length 28 to 35 mm.

Head comparatively large, warm brown above, opalescent green beneath and at the sides ; occiput brown ; vesicle rounded or with two obscure points, brown; front a dark, greenish yellow or blackish and very glossy, almost metallic ; epistome, labrum, and labium pale greenish yellow.

Prothorax, moderately large, rounded and slightly notched lobe, dark brown and with a broad, mid-dorsal, greenish yellow fascia.

Thorax blackish brown on the dorsum where the mid-dorsal fascia of the prothorax is continued backwards over the tergum to the dorsal surface of the abdomen. The sides pale and in juvenile specimens yellowish.

Legs black, the extensor surface of the tibiæ yellowish. The terminal spine of the hind femora very long.

Abdomen slender, of even thickness, strongly keeled, blackish brown or black, with the mid-dorsal, yellowish-green fascia continued back as far as the 8th segments. Anal appendages pale, creamy yellow.

Wings moderately broad and rounded, the basal half jet black in both wings, this colour extending outwards to a little beyond the node and curving inwards towards the base near the termen and bordered outwardly by a broad, opalescent, white fascia to about halfway to the stigma. Membrane and stigma black. No supernumerary nervures to the bridge ; 5 cubital nervures in the forewing, 2 in the hind ; trigone and hypertrigone in the forewing traversed twice, in the hind once. The reticulation over the black area ochreous or reddish.

Sexual organs as for the genus.

Female strikingly different from the male, so much so, that the two sexes were described as two different species by Fabricius under the names *equestris* for the male, and *lineata* for the female.

Expanse 40 to 45 mm. Length 30 mm.

Head much paler in colour, the front, epistome, labrum and labium a pale greenish yellow ; vesicle and occiput olivaceous.

Prothorax and thorax marked as in the male but the colour much paler, the side pale greenish yellow and only the mid-dorsal fascia bordered by a diffuse, brown stripe. Legs yellow, the distal ends of femora, brown. Abdomen pale greenish yellow, with a fine, mid-dorsal black line and a broad, blackish brown stripe subdorsally which meet over the dorsum on the 9th segment. The 10th yellow, with two small, subdorsal spots, black.

Anal appendages pale yellow.

Wings hyaline, the basal half from just distal to the node, a pale amber yellow; this area bordered outwardly by a broad, ragged, smoky brown fascia extending from the costa nearly to the termen and curving inwards towards the base near the termen, in the hindwing. The apices of all wings broadly smoky brown. as far inwards as inner end of stigma. The inferior, costal space blackish-brown.

Sexual organs not differing markedly from the genus.

Hab. India, Burma and Ceylon in the moist areas. I have taken this insect in Calcutta, Madras, Bombay, Elephanta Island, Nilgiris, Colombo and Bangalore. In the latter district, it is exceedingly local but where found, very plentiful. It favours swampy areas such as new paddy fields or low, moist jungles and may on occasions be seen flitting in countless swarms, its flight reminding one strongly of an Hesperid. Variation is not a noticeable characteristic.

42. Neurothemis tullia feralis.

Male: very similar to *tullia tullia,* but the white opal band across wings is absent in the male. The base of wing is black as far as 2 cells proximal of the node in the forewing and to the node in hindwing.

Female similar to *tullia tullia.* A bright yellow at base of wings and a dark apex, the dark ray in the subcostal space and the postnodal dark band absent

Hab. I include this as doubtful from Burma. Malacca, Java, Siam.

43. Neurothemis intermedia intermedia, Ris.
Libellula intermedia, Rambur.
Trithemis intermedia, Brauer.
Neurothemis intermedia, Selys.

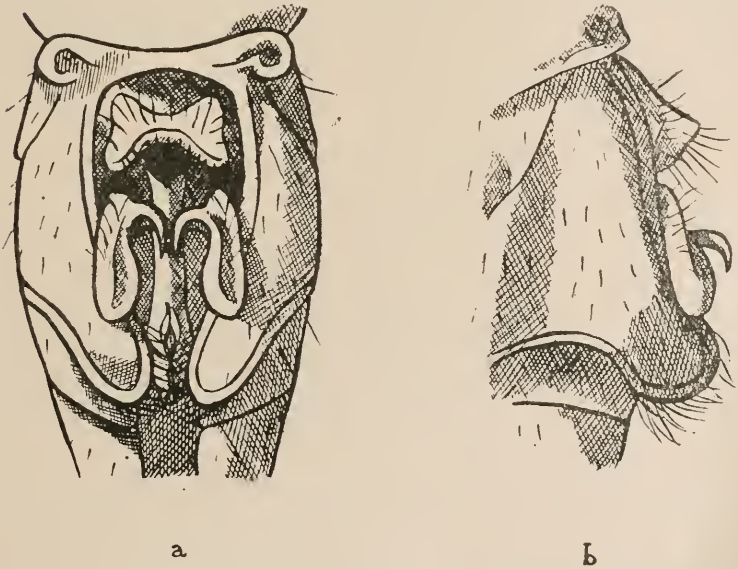


Fig. 40.—Sexual organs of *N. intermedia intermedia,* (*a*) of the male seen from the front. (*b*) Ditto from the side, (×20).

Male and female scarcely differing and only distinguished by careful scrutiny. Expanse 52 mm. Length 32 mm.

Head : eyes puce brown above, rusty at the sides and greenish yellow beneath ; occiput reddish brown ; vesicle olivaceous ; front, epistome and labrum pale yellow, often with a rusty tinge especially below.
Prothorax sandy, the lobe small and but faintly notched.

Thorax pale olivaceous on the dorsum, with a goldon sheen, a broad, dark brown, humeral fascia. The tergum pale olivaceous green, pale greenish yellow laterally or often a shade of pale salmon pink. The legs sandy.

Abdomen long and slender, of even width throughout, strongly keeled, a golden brown or ochreous, marked subdorsally with a diffuse, brown stripe. In many specimens the dorsum of the first few segments are pale olivaceous green, this colour being continued on from the tergum, and the sides of the distal segments are markedly ferruginous.

Anal appendages ochreous.

Wings hyaline, relatively broad and large. In the male, both wings to rather beyond the trigone, tinted with an amber coloured suffusion varying in intensity according to the age of the specimen and to a less extent according to the season or locality. As a rule wet season forms are of a darker colour than those taken during the dry. The amber tinting spreads out as far as the stigma between the costa and the subcosta. In the female, the basal marking is absent but the tinting is present between the costa and 3rd nervure as far out as the stigma. Stigma rusty red ; membrane a smoky brown ; cubital nervures 2 to 3 in the forewing, 2 in the hind.

Sexual organs of male and female not differing from the genus.

Hab. India, Burma and Ceylon, in the moister areas and at elevations below 2,000 ft. This species is found throughout the year and is usually very common. It is rarely if ever seen frequenting the neighbourhood of water preferring long grass, from which it may sometimes be seen rising in hundreds.

44. Neurothemis intermedia degener, Selys.

Neurothemis intermedia, Selys.
Neurothemis septentrionis, Förster.
Expanse 50 mm. Length 32 mm.

Male and female very similar.
Head, thorax and abdomen coloured very much the same as in the foregoing species.

Wings hyaline and particoloured : relatively broad and long. In the male, the marking of a uniform, bright reddish yellow, somewhat darker at the costal stripe and with red reticulation. It extends outwards from the base as far as 2 cells proximal of the stigma. In the forewing its border slightly convex, in the hind, sloping sharply backwards and inwards towards the anal angler the anal border being hyaline for about one cell's breadth. In some species the colour is a deeper, reddish brown, the cell middles being paler and the border of the wings grained.

A dark ray may be present in the subcostal space and a clear area immediately posterior to it. In the female a dark costal streak extends out as far as the stigma, expanding somewhat at the node and the apices of the wings are yellowish as far inward as the middle of the stigma.

Stigma dark, reddish brown, 3·5 mm.

Hab. Burma, Bhamo, Assam and Bengal.

45. Neurothemis fluctuans, Hagen.

Libellula fluctuans, Fabricius.
Polyneura elegans, Rambur.
Polyneura apicalis, Brauer.
Neurothemis ceylanica, Brauer.
Neurothemis nicobarica, Brauer.
Neurothemis palliata, Hagen.

Expanse 50 mm. Length 32 mm.

Male and female very similar.

Head : front reddish ; epistome, labrum and labium yellow.

Prothorax dark reddish brown.

Thorax reddish brown, dark olivaceous on the dorsum and a paler russet green at the sides and beneath.

Abdomen ferruginous with obscure, blackish, subdorsal spots.

Wings moderately broad and long ; in the male, the basal marking, which is of a golden brown or black colour with reddish reticulation, usually extending as far out as the stigma but subject to a little variation of 2 or 3 cells more proximal or distal ; in the forewing, the border of this marking a little convex, in the hind, sloping strongly towards the base so that it reaches the termen at a point somewhere between the terminal end of the 6th nervure and tornus. Secondary reticulation not a marked feature, the trigone in the forewing having about 5 or 6 cells and the hypertrigone 5 to 8. In the female the colour of the wings varying considerably ; either hyaline or tinted dull yellow, the basal marking in the hindwing usually small, not extending as far out as the trigone and its border vignetted off. The apices of the wings touched variably with brown, this colour occasionally extending as far as the middle of the stigma and having a sharply defined border. In other female specimens, the basal marking is better defined and is of a clear yellow or yellow with dark, diffuse clouding at its outer border or it may be a dull brown without any rays at the base. Stigma moderately large, dark brown.

Hab. Malaysia, Straits, Nicobars, Ceylon and Lower Burma.

46. Neurothemis terminata, Ris., 1911.

Neurothemis fluctuans, Brauer.
Neurothemis fluctuans, race *apicalis,* Selys.
Neurothemis stigmatizans, Laidlaw.

Expanse 62 mm. Length 40 mm.

Larger insects than the two last and rather darker in colour ; markings if any, rather obscure.

Head, thorax and abdomen a golden brown.

Wings broad and long ; in the male, the basal marking extending variably outwards to as far as the stigma or rather wider, its border without indentation and running straight back to the termen, which it reaches a little distal to the end of the 5th nervure. Secondary reticulation rather more developed than in the foregoing two species and reddish in colour. Trigone in the forewing with 6 to 7 cells, in the hypertrigone some 3 or more cells, subtrigone in the same wing with 12 to 24 cells ; stigma dark brown, rather more than 4 mm. In the female, reticulation more open, the markings varying widely but usually the wings a bright yellow with poorly defined darker marks at the membrane and brown tips to the extreme distal ends of the wings, this latter marking not usually extending in beyond the distal end of the stigma. In isochromatic females, which are less common, the wings are yellowish with a diffuse, brown clouding at the node, reaching as far out as the proximal end of the stigma.

Hab. Ceylon and the Nicobars.

Genus—BRADINOPYGA.

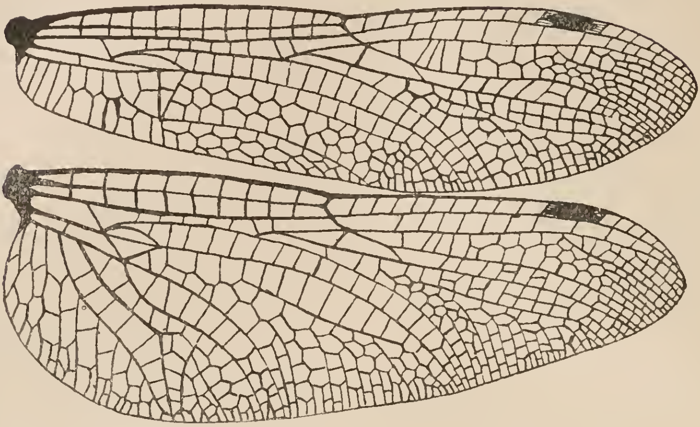


Fig. 41.—Wings showing neuration of *Bradinopyga geminata.*

Head : eyes broadly contiguous; forehead narrow and sloping ; suture moderately deep ; vesicle rounded or with two small points.

Prothorax ; posterior lobe small, rounded procumbent.

Thorax robust.

Legs moderately short and slim. Hind femora with numerous, closely-set, short spines ; mid-femora with a row of gradually lengthening spines ; tibial spines numerous, about 12 pairs. The leg armature about the same in the sexes.

Abdomen at the base, a littledorso-ventrally dilated, very slightly constricted at the 3rd segment, sides nearly parallel and tapering very gradually to the end. A more or less distinct, transverse ridge on the dorsum of the 4th segment.

Wings long and moderately broad ; trigone in the forewing one or two cells distal to the line of the trigone in the hind ; sectors of the arc in both wings with a long fusion ; arc between the 1st and 2nd antenodal nervures ; 8th nervure in the hindwing arising from the anal angle of trigone ; antenodal nervures 10½ to 12½, the final complete ; trigone in the hindwing at the arc or a little proximal ; 1 cubital nervure to all wings ; no supplementary nervures to the bridge ; trigone in the forewing traversed occasionally twice ; trigone in the hind entire or traversed, its distal side concave ; all hypertrigones entire ; 4th nervure markedly undulating ; discoidal field generally with 4 rows of cells, occasionally a more or less lengthy space with 3 rows of cells ; strongly dilated at the termen ; anal field in the hindwing broad ; loop long and broad and with divided cells at the outer angle ; cells between the inner border of the loop and the base of wing arranged in transverse rows.

Stigma of medium size. Membrane large.

Only one species which is readily distinguished by its stigma, which is blackish and white at both ends. *Trithemis pallida* has a somewhat similar coloured stigma but the number of antenodal nervures in this insect do not average more than 8½, whereas *Bradinopyga* has not less than 10½.

47. Bradinopyga geminata.

Libellula geminata, Rambur, 1842.

Expanse 70 mm. Length 44 mm.

Head : eyes brown above, opalescent or purplish at the sides and beneath ; vesicle black ; occiput brown ; front, epistome, labirm and labrum brown mottled obscurely with white and black, anastomosing streaks.

Prothorax brown with similar mottling.

Thorax brown mottled with grey, white and black streaks which anastomos in an irregular pattern. Legs blackish brown.

Wings hyaline; many of the basal nervures and all the antenodal nervures yellow; 10½ to 12½ antenodal nervures in the forewing 9 to 10 in the hind; stigma blackish brown with a spot of white at either end.

Abdomen similar in colour to the thorax, cinerous beneath, the intersegmental nodes ringed with black. Anal appendages white.

Female: Expanse 45 mm. Length 75 mm.

Very similar to the male but rather lighter in colour. One antenodal nervure less in both wings than in the male.

Hab. The single species taken in India has a wide distribution, being found in the plains and submontane areas throughout India, Ceylon and Burma except in the desert tracts. The insect has a curious habit of sunning itself on walls coated with cement, or on the sides of wells.

I have seen numbers resting on the face of the granite rocks on Elephanta Island, and in all such situations, owing to its cryptic colouring, it is well nigh invisible. Possibly the habit is of a protective nature or it may aid the insect in stalking its prey. Rambur described the species as from Bombay as far back as 1842.

Genus—CROCOTHEMIS.

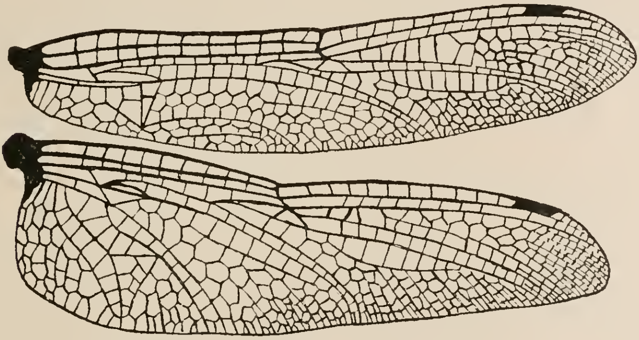


Fig. 42.—Wings of *Crocothemis servilia.* (×2½)

Crocothemis, Brauer, 1868.

Head large and globular: eyes shortly fused: forehead projecting, the suture very deep and separating two horse-shoe shaped, flat areas: vesicle rounded.

Prothorax: posterior lobe very small and rounded, middle lobe fringed anteriorly with long hairs.

Thorax robust, legs moderately long and robust, the hind femora with a row of closely-set numerous short spines of uniform size and with a much longer one at the distal end; tibial spines numerous, fine and of medium length: claw hooks robust, nearer the distal end of claws. Armature in the female very similar.

Abdomen broad, sides parallel or slightly fusiform and tapering strongly near the end: in the female the sides parallel: both sexes strongly carinated along the dorsal ridge. Anal appendages closely-set and long.

Wings long and of medium width: reticulation close: trigone in the forewing about one cells breadth distal to the trigone in the hind: sectors of arc in the forewing moderately short, a much longer fusion in the hind: arc between the 1st and 2nd antenodal nervures: 8th nervure in the hindwing arising from the anal angle of the trigone or in very occasional specimens, slightly separated from it: antenodal nervures 9½ to 10½ the final incomplete: base of trigone in the hindwing at the arc: 1 cubital nervure to all wings: no supplementary nervures to the bridge: trigone in the forewing traversed once, rarely twice: subtrigone with 3 cells: trigone in the hindwing entire: all hypertrigones entire: 4th nervure slightly undulated: 8th nervure strongly arched: discoidal field with 3 rows of cells (occasionally 2 or 4, but this very rare). strongly dilated at the termen: 1 row of cells between 5 and *5a*: anal field of hindwing broad, the loop broad and extending 3 cells beyond trigone and with bifurcated cells at both angles: stigma and membrane large.

Two species have been described from within Indian limits, *viz.*, *servilia* and *erythræa*, but having examined some hundreds of specimens collected over a wide area which included Egypt, Mesopotamia, South Persia, Sind, Bombay, the Deccan, the Carnatic, Madras, Assam, Burma and Ceylon, I have come to the conclusion that the two cannot be separated. It is possible to form a complete series including both species and when large numbers are examined, the specific characters break down everywhere, especially as regards the wings, the reticulation of the apices and the apical and basal markings. I consider them to be transitional forms towards the establishment of at least three different species but find it more convenient to describe them under one heading with two varieties, a small and a large red form and a yellow variety, of which I call the former *C. servilia servilia*, the large red form, variety *maxima*, and the latter, variety *erythæa*. It must be noted however that as these three are not infrequently seen pairing with one another and as the neuration in all closely agrees, the division is a purely artificial one. All forms are yellow in the teneral stage, but this colour is retained in the adult stage of *erythæa* only, the others assuming in a few days a brilliant red colour. *Erythæa* in its colouring conforms with what is usually found to be the case with desert species, the greater number of which, especially in Mesopotamia, are of a sandy yellow tint.

28. Crocothemis servilia servilia.

Crocothemis erythæa, Selys.
Crocothemis soror, Kirby.
Crocothemis reticulata, Kirby.
Libellula servilia, Drury.
Crocothemis servilia, Brauer.
Erythemis servilia, Brauer.
Libellula ferruginea, Fabricius.
Libellula soror, Rambur.

Expanse 55 to 60 mm. Length 35 mm.

Male: head; eyes reddish brown or deep blood red above, opalescent or purplish at the sides and beneath; occiput olivaceous; vesicle, frons, epistome and labrum brilliant red or the lower part of epistome and the labrum may be orange or yellowish.

Prothorax ferruginous.

Thorax reddish brown without markings, densely pubescent. Legs reddish brown.

Abdomen and anal appendages a bright carmine red with no markings.

Wings hyaline, reticulation close, especially at the apices, an amber coloured, basal marking which in the forewing is only present in the inferior costal space, the subcostal and cubital spaces at the extreme proximal parts. In the hindwing this marking is of variable extent, reaching as far the 1st antecubital nervure, rather beyond the cubital nervure and from thence in a convex margin as far as the tornus. Antecubital nervures 10½ to 11½. In occasional specimens the apices of the wings are distinctly smokey. Stigma deep amber heavily bordered with black.

Sexual organs prominent, reddish in colour: lamina broad but recumbent: external tentaculæ projecting, foliate: internal tentaculæ stout, curved, black-tipped hooks: lobe prominent and arched.

Female:

Head: eyes brown above, lilaceous at the sides and beneath: occiput olivaceous: vesicle brown: frons, epistone and labrum pale yellow.

Prothorax brown or ochreous.

Thorax a golden brown without markings. Legs ochreous with black spines.

Abdomen olivaceous brown, with a fine black dorsal carina.

Wings as for male but the basal markings paler and the reticulation yellow instead of red as in the male.

Hab. Throughout Continental India, Burma and Ceylon. I have seen it also in fair numbers in Basra, Bushire and Suez, but in these places it is largely replaced by the yellow form *erythœa.*

49. Crocothemis servilia servilia., var. *maxima.*

Expanse 65 mm. Length 45 mm.

This species does not differ in colour from the foregoing but it is of a much larger size and is apparently a local insect. I have only taken it in Poona district. Usually it shows bilateral polymorphism as regards the neuration of the wings, thus quite occasionally the discoidal field of one side begins with a row of 3 cells and is then continued as 2 rows of cells.

In this respect it resembles *R. rufa* so elosely that it is only with great difficulty distinguished from that insect, usually however this character is present only on one side. Very occasionally the antecubital nervures number 12½ on one side and 10½ on the other. Generally it is of a much more brilliant red than *servilia servilia.*

50. Crocothemis servilia servilia., var. *erythœa.*

Crocothemis erythœa, Brauer.
Libellula ferruginata, Fabricius.
Libellula victoria, Fourcroy.
Libellula rubra. de Villers.
Libellula ferruginea. Van der Linden.
Libellula erythœa, Brulle.

Expanse 55 mm. Length 35 mm.

Male and female very similar.

Head: eyes puce coloured above, ochreous at the sides and beneath: occiput olivaceous: vesicle brown: frons, epistome and labrum a pale straw colour but in some males the frons is ochreous.

Prothorax olivaceous brown.

Thorax a golden yellow, rather darker on the dorsum and with a usually sharply defined, antehumeral, pale whitish green stripe. The sides much paler especially in the female and with a distinct greenish tinge. Legs olivaceous. A whitish green stripe on the tergum.

Abdomen ochreous, this colour being most intense along the sides, paler on the dorsum, the dorsal earina finely black. Anal appendages yellowish.

Wings hyaline, the apices more often than not tinted faintly and diffusely with brown or sepia. An amber suffusion, pale and diffuse, runs along the costa of both wings and blends with the basal marking which is more diffuse and much paler than in *servilia servilia.* Stigma bright yellow.

Hab. Mesopotamia, Egypt, Southern Europe, throughout Africa, Quetta, Bombay, Poona and Ceylon. I have noticed specimens of this insect on board ship during voyages from the Persian Gulf to Karachi and Bombay, so possibly its spread has followed trade routes. I am of opinion that specimens from India have in the past been regarded as teneral forms of *servilia servilia.*

(*To be continued.*)

SUB-SPECIES AND THE FIELD NATURALIST

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

A letter which has recently been circulated to all Members of the British Ornithologists Union has attracted my attention, because in it the assertion is made that modern scientific methods are opposed to the work of the Field Naturalist. Now my own work, such as it is, has been until the last few years purely that of a Field Naturalist, and it seems to me that no assertion has ever been made showing a profounder ignorance of the true facts of the case, indeed it is probable that no scientific or thorough field worker will attempt to refute the contra-assertion that Modern Museum Naturalists are far more dependent on the field-observer than were those of earlier times.

The assertion in the letter is based on two grounds, first the wicked and foolish system of trinomialism, or sub-specific classification indulged in by modern ornithologists, and secondly the attempts of these same ornithologists, to enforce a system of nomenclature, which shall be permanent and stable. I propose to comment on these two accusations separately.

In the first place, what is a sub-species or the form of variation to which we give the honor of a third name? The generally accepted answer to this is as follows. A *sub-species* is a geographical race or variation differing in some respect from the form first described as the species, yet linked to it by other intermediate forms found in intervening areas. It is essential, however, that to entitle such a variation to a trinomial, it should have arrived at a point in its evolution sufficiently advanced to enable it to exist as a permanent form within some definite area. From this it will be seen that a sub-species is merely a term for a species in the making. Once Nature has advanced in evolution to the time, when the links or intermediate forms have ceased to exist, then the sub-species will attain the full status of species, because they will be definitely severed from their nearest allies. This will, of course, never happen in its entirety, for Nature is perpetually at work creating new forms and variations suitable to their environments, whilst destroying those which are unsuitable, and thus unfitted to carry on the work of perpetuation. In former days specimens frequently came to Museums and Private Collections with no date whatsoever as to where, when or how they had been collected, but the specimens, if sufficiently distinct from any known form, were very properly given a name. To such an extent, however, did this obtain that birds were occasionally named after a locality in which they never occurred, simply because the person who eventually obtained and named the skins had not recognised the importance of getting with them correct data, or had accepted the first statement made without further inquiry. Now-a-days binomialism does not suffice to cover the whole range of differentiation in species, because Field Naturalists have shown from their observations that species vary according to their geographical distribution, as governed by varying conditions of temperature, humidity, and many other factors. It is to describe these variations in the shortest manner possible that trinomials, or sub-species, have come into use. Now the whole of the material facts upon which this work of trinomialism can be carried out must be collected by Field Naturalists, and it is only from their discoveries and observations that the Museum Naturalists have data upon which they draw their reductions and form their conclusions. For instance, no Museum Naturalist can take 1,000 specimens of a species collected in any one country and say, "Here we have so many variations in structure or colouration which constitute so many sub-species." It is not until the careful Field Observer gives him information as to where, when and how each specimen has been collected, in what kind of country and at what elevation it has been found that the Museum man can tell whether the variations are merely individual or are the effect of an environment which necessitates or encourages their evolution.

Classification of the living members of the Class "*Aves*," like every other classification, is intended to simplify or make easy the attainment of knowledge. In the present instance it should assist in the acquirement of knowledge, both of ornithology as a whole, as well as of each individual species, its life history, and all other facts connected with it. If the classification employed helps towards this end, it is scientific; if, on the other hand, it renders the acquisition of knowledge more difficult, it is not scientific, and should be discarded.

But the writer of the letter to which I have referred, and a few others of similar mentality, do not argue on these lines. In effect, what they do say is this: "The old system of dividing birds into species is sufficient for me, and I have no desire to learn anything more. I do not intend to have anything to do with the attempt of modern ornithologists to work out the marvellous evolution of Nature in forming variations to suit the needs of their immediate environments. It is nothing to me that Nature evolves a dark bird which may obtain safety in the deep shadows of evergreen forest, whilst its cousin attains a white or pale coat which renders it inconspicuous in snow or sunlit grass-land. It is of no interest to me to know that a migratory bird has developed long wings, whilst its sedentary relation has them shorter and weaker."

Dark colour and light colour, strong wings and weak ones, are, of course, two of the simplest developments in evolution, and any child can understand them, but the reasons for the many other differences existing, often in but slight degree, between subspecies are still beyond what we can now interpret; on the other hand, the material we of this generation are busy collecting and collating will assuredly help those of a future generation to decipher the puzzles which we now grapple with in vain. Each generation has at its disposal the collective knowledge of previous workers, and the Naturalist who desires to add something new to the sum total of existing recorded facts must not only assimilate the accumulated knowledge of his predecessors, but must constantly seek fresh fields of learning.

When ornithology was in its infancy, birds were lumped together under one name in the most extraordinary way, and at this period much the same degree of nomenclature obtained amongst civilized people as obtains to-day among savage tribes. Thus there were groups of birds known as Vultures, Eagles, Ducks, Storks, Owls, Flycatchers, and so on; sometimes these were again divided into "large" or "small", and sometimes a second qualifying name was added, denoting some conspicuous character. As time progressed these larger divisions were gradually broken into smaller and smaller ones, until eventually most birds which differed conspicuously from others had a definite trivial name. To this succeeded a time when Latin and Greek, or pseudo-Latin and Greek, names were given in addition to the local trivial names, thus enabling workers to recognise the bird spoken or written about, whatever the language employed in the context. At this period and for a long time after, fresh discoveries were constantly being made; unknown countries were still plentiful, and Naturalists had more than sufficient to employ them in working out new species on the very broadest lines. Under such circumstances minor differences were either overlooked or ignored, whilst the causes for these same differences were never sought for.

Now, however, we live in a time when there are but few countries left to explore, and novelties of specific rank are few and far between, consequently minor differences attract attention to a far greater degree than was previously the case. Together with these differences the worker now seeks to elucidate their causes, thus necessitating a knowledge of their life history quite unnecessary so long as one was content to acknowledge only such striking features as were visible without search to everyone. A very much finer division of living objects becomes possible to the modern ornithologist, for whom the material to be worked on has already been collected and classified on broader lines by the Naturalists of previous generations. Hence we have come to the use of trinomials to denominate geographical differences existing in the same species under different circumstances and in varying environment.

As regards the second accusation levelled against Modern Naturalists, that of upsetting long existing names in their attempt to regulate nomenclature as a whole, it is curious that the accusation is nearly always made by the same individual, who inveighs against trinomialism. If we examine the reasons given for the accusation, it invariably comes to this, that by giving names to birds which are not those by which the accuser knows them, we inconvenience *him*. There can be but one correct name for a bird, and Naturalists of the calibre who complain because their personal convenience and sympathies are not consulted forget that no generation works for itself alone and its own pleasure. It is the duty of each generation to put classification and nomenclature —amongst other things—on as stable a basis as possible for the generations to follow, and the only way to do this is to make some definite rule as to nomenclature and adhere to it. The rule thus made by the International Congress and universally agreed to is that priority of nomenclature shall be strictly adhered to with effect from the date of the 10th Edition of Linnæus (1758), the founder of binomialism. This of course means that from time to time some long accepted name has to be discarded for another hitherto overlooked and unknown, which preceded it. Naturally our own sympathies are in favour of the continuation of the name we have known all our lives, but our children will always know it by the new name, and will not be bothered with this question of sympathy, if we are only consistent, and adopt as soon as it is ascertained the name to which the bird is properly entitled. If ornithologists of the present generation do their duty without first stopping to consider whether it will inconvenience them personally, those of coming generations will have, but little left to do in reference to classification and nomenclature. All this, the rough foundation work of ornithology will have been threshed out by ourselves, and perhaps those who next succeed us. Those later to come will be employed in elucidating cause and effect, not in finding out what is, but in ascertaining *why* it is and *how* it has become so. The ornithologist will not want to find out in what respect one bird differs from another, where it lives and how it feeds. All this will be ready prepared for him to acquire speedily from books, and it will be his duty to continue the investigation into reasons and results, and to tabulate what he learns as the basis of work for yet future generations.

So too, the Oologist will no longer want to know what bird lays what kind of egg, but will be discovering why each particular kind of egg is laid, how and why it is pigmented in a thousand different ways, together with the attendant anatomical and biological circumstances.

Practically all scientific Zoological research resolves itself into an endless inquiry into the ways of evolution. Each successful Naturalist adding during his life something to the accumulated mass of accepted facts upon which others shall build up either additional facts, or shall make some discovery which shall further enlighten humanity upon the ways and means of the great mystery of creation and perpetuation of life by evolution.

To me it seems that when we find out a few facts entitling geographical races to trinomials, we are adding a few bricks to the foundation of the building whose coping stone shall be complete knowledge.

To those of us who are Field Naturalists in India, correct nomenclature does not, of course, appeal with any great force ; but on the other hand, the existence and definition of sub-species is a factor of the greatest interest. A Government officer in the course of his duty may have to visit the snow-clad mountains of the Himalayas, the dense, humid forests of Assam and Burma, the arid plains of Sind and Rajputana, or the never varying heat of South India, Ceylon or Tennasserim. Over all these greatly contrasting areas, he may meet with the same species of bird, perhaps all varieties included in the standard works under one name, or perhaps divided into half-a-dozen so-called species.

When quite a young man, intensely interested in ornithology, and living in a part of India teeming with bird-life, I was constantly confronted with difficulties in ascertaining the name of some particular bird. Sometimes it seemed to me that the descriptions of two or three birds would equally well apply to the specimen in hand, whilst at other times no description seemed correct in every particular, and it was quite impossible to say to which of two or more descriptions my bird should be allotted. Gradually it dawned on me that in many cases geographical variations of the same species had been all lumped under one specific name, and in others these had been split up into several species under different binomials. At this time several leading scientists were beginning to work out a system of sub-species with trinomials, and when I had read some of their articles, my difficulties began to disappear. Having grasped the idea of their system, there opened before me the wonderful scheme of creation by evolution, the constant standardization (if I may use such a term) of variations in structure and colour which help to maintain existence with the corresponding elimination by destruction of all unnecessary or injurious characteristics.

The need for trinomialism is brought home to us in India very plainly by the study of our two most common birds, the House-Crow (*Corvus insolens*), and the Bulbul (*Molpastes hæmorrhous*). Thus the common House-Crow is divided by Blanford and Oates into two species, *Corvus splendens* in India, and *Corvus insolens* in Burma. But if we study the forms in various areas, we find that there are still two geographical races which differ even more from the typical Indian bird than does the Burmese one. These two races are the small very dark bird from Ceylon and another from Sind which has the paler plumage so light that it appears almost white. If one merely had typical specimens of the Ceylon bird (*Corvus splendens protegatus*) and the Sind bird (*C. s. zugmeyeri*) to examine, one would at once say here are two excellent *species* of Crow *very* different from one another. When, however one has a series from all over India and Burma, it is easy to see that all are one and the same species, but that the dry, glittering plains of Sind have affected the plumage, until the pale brown has been bleached almost white, whereas in Ceylon and Burma the constant humid heat has deepened it until the whole bird is practically black. As regards the Bulbuls, the authors quoted have been very generous in the number of species allowed, and we find *Molpastes hæmorrhous*, the common Madras red-vented Bulbul, masquerading as a good species in no less than six areas, *i.e.*, Ceylon and the greater part of Continental India, (*hæmorrhous*), Punjab and N.-W India (*intermedius*), Bengal, Assam, and N. E. India, (*bengalensis*), Manipur and W. Burma (*burmanicus*), Kachin Hills, Shan States and N. E. Burma, (*atricapillus*), and finally S. E. Burma, and Tennasserim, (*nigripileus*).

But these are nothing but geographical races of one and the same bird, each race grading into the next. Thus, between any two adjoining races within certain areas surrounding each specialised area, there is some form of bird not stable, but varying individually in degree, which is neither one race nor the other, but half-way between the two.

Hume, one of the greatest ornithologists, who combined in himself equally the attributes of the Field and the Museum Naturalist, long ago *nearly* grasped the question of geographical races and sub-species. For instance, dealing with the species of Crow-Pheasant, he divided this into several species, shewing the differences between the races with great accuracy, but eventually, finding that though the extremes varied, they all ran into one another, he once more lumped them under one name. At the same time he definitely laid down the fact that here we had one and the same species of bird with various different races in different geographical areas.

Perhaps the most difficult point for the young ornithologist to get over was the chronic inconsistency of all the standard books, such as those of Jerdon, Hume, Blanford and Oates, etc. All these authors at times accepted the smallest of differences between adjoining races as sufficient reason for making them species, yet in other instances, far greater geographical variations are passed over in silence. A good example of this may be found in the Cuckoo Shrikes. Here we have the dark Grey Cuckoo Shrike (*Campophaga melanoschista*) and the Pale Grey Cuckoo Shrike (*C. melanoptera*) given the status of species, yet under the one name of *Graucalus macei* we have lumped together the small bird from Ceylon, the large one from Northern India, and the bird from Siam and Burma, which differs utterly in having the female the same as the male, instead of barred on the chest and throat.

The above are merely odd instances cited from amongst an unfortunately large number of similar cases, but will suffice to shew that trinomials are not only necessary, but will actually help the learner to identify the birds he comes across. Also they will shew him how important it is for the Field Observer to make the most careful notes to be attached to each specimen he collects, for without these data neither he himself nor any Museum Ornithologist will be able to make a correct interpretation of what he sees. Thus the modern Museum Naturalist, as I said in the first lines of this article, is absolutely dependent on the work of the Field Naturalist, and according to the latter's keen powers of observation, accurate recording and ample notes, will be the value of the deductions the former can draw.

THE FLORA OF THE INDIAN DESERT. (JODHPUR AND JAISALMER.)

BY

E. Blatter, S.J. and Prof. F Hallberg.

Part II.

With 13 plates.

(*Continued from page 246 of Vol. XXVI.*)

Rosaceæ.

Neurada L.

Neurada procumbens, L. Sp. Pl. (1753) 441.

Loc.: Jaisalmer: Jaisalmer, gravel (No. 9329 !), on sand (No. 9008 !), Vinjorai, dunes (No. 9330 !).

Distrib.: N. Africa, Arabia, Persia, Afghanistan, Sind, Punjab.

Flowers and fruits in Nov.

Combretaceæ.

Anogeissus Wall.

Anogeissus pendula, Edgew. in Journ. As. Soc. Beng. XXI (1853) 171.

Vern. N.: Ehndruk, dhau.

Loc.: Jodhpur: Kailana (No. 6597!), on the rocks between Sagur and Balsamand (Macadam.). Jaisalmer: Amarsagar (No. 6598!), Bads Bag near Jaisalmer (No. 6596 !), generally in rocky places (Macadam).

Distrib.: Gujarat, Bundelkhand, N.-W. Provinces, Rajputana.

Fr. in October and November.

Uses: The wood is extremely hard and consequently difficult to work, but is excellent where a hard wood is necessary, in cabinet-making, in-laying, etc. The leaves are used in dyeing, producing a dark green (Macadam).

Anogeissus acuminata, Wall; Bedd. Fl. Sylv. t. 16.

Vern N.: Dau.

Loc.: Marwar (Macadam).

Distrib.: Rajputana, Central Provinces, Northern Circars, Burma, Chittagong.

Uses: The wood, which is very hard, is excellent for cabinet-making, in-laying, etc. Also used for building purposes (Macadam).

Anogeissus rotundifolia, spec. nov.

Arbor circa 6 m. alta (quam vidimus). Partes novellæ (rami, folia, inflorescentia) cinereo-tomentosæ. Folia alterna, numerosa, juniora late elliptica vel suborbiculata, matura vero orbiculata vel suborbiculata, latiora quam longa, diametrum 2 cm. attingentia, apice ebtusa, rotunda, vel emarginata, generatim mucronata. Nervi laterales, generatim 7, prominentes in facie inferiore. Petiolus 3 mm. attingens, fortis.

Pedunculi subterminales vel axillares, solitarii, foliis longiores (sæpe duplo). Capitula globosa, densa, 15 mm. attingentia (staminibus exclusis). Calycis tubus compressus, 2-alatus, pars alata 1 mm.

longa, 2 mm. lata, pars supra ovarium longe attenuata et producta 5 mm. longa (brevi post anthesin); alæ glabræ vel fere ita, brunneæ, subobtusa, margine integerrimo; limbus late campanulatus, 1·5 mm. in diametro, paullulum pubescens. Stamina exserta, filamentis brunneis, antheris flavis.

Fructum maturum non vidimus.

Distinguitur a ceteris *Anogeissi* speciebus forma et magnitudine foliorum.

On the stem at the base of the petiole of the leaf there is on each side a group of minute fleshy filiform protruberances, about *1* mm. long.

In one instance a complete axillary solitary sessile flower-bud was observed.

Locality: Kailana near Jodhpur, found in flower in October 1917 (Nos. 6594!, 6595!).

NOTE: Differtne specifice ab *Anogeisso coronata* Stapf in Kew Bull. No. 4 (1414) 153 ?.

Anogeissus sericea, Brand. in Ind. For. XXV (1899) 287, *var. nummularia*, Duthie. Fl. Upp. Gang. Plain I (1903). 340.

Loc.: W. Rajputana (King).

Distrib.: Merwara, W. Rajputana.

MYRTACEÆ.

Psidium L.

Psidium guyava, L. Sp. Pl. (1753) 470.

Vern. N.: Amrud.

Loc.: Jodhpur: Jodhpur where water is plentiful (Adams). Jaisalmer Amarsagar (No. 7133!), Bada Bag.

Native country: Mexico.

Eugenia L.

Eugenia jambolana, Lam. Encycl. Meth. III (1789) 198.

Vern.: Jamun.

Loc.: Jodhpur: Balsamand (No. 7277!). Jaisalmer: Amarsagar (No. 7276!), introduced.

Distrib.: Indo-Malaya, Australia.

Fl. in November.

Eucalyptus L'Herit.

Eucalyptus sp.

Loc.: Jodhpur: Kailana (No. 7278!), introduced.

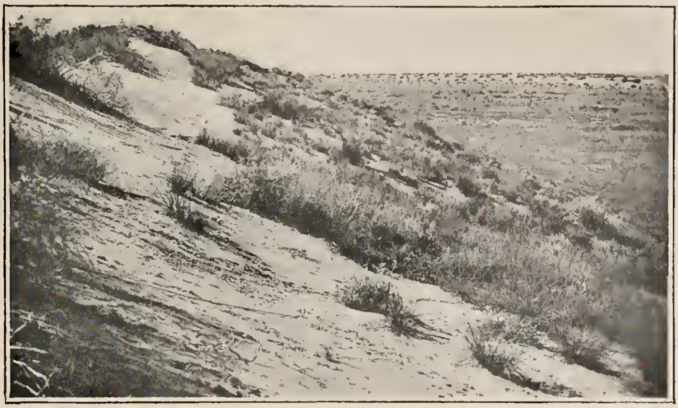
Native country: Australia.

LYTHRACEÆ.

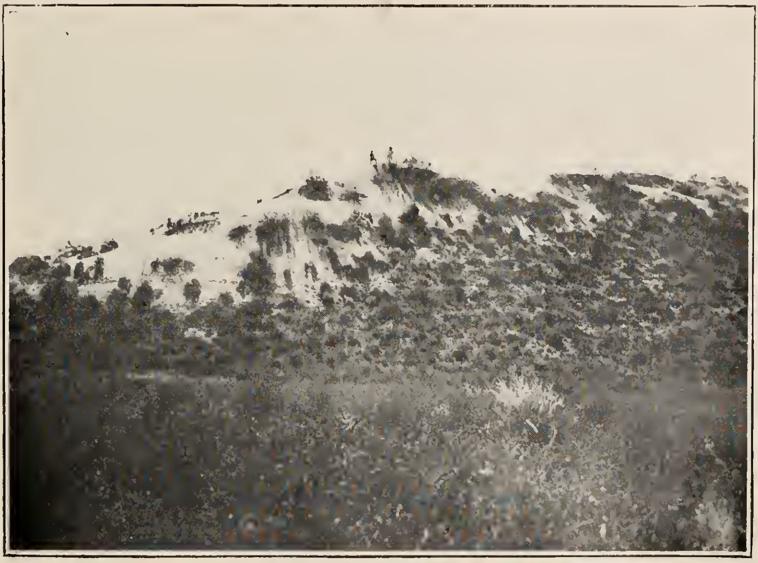
Ammannia L.

Ammannia baccifera, L. Sp. Pl. (1762) 175.

Loc.: Jodhpur: Jodhpur (No. 3480!), Balsamand (Nos. 3412!, 6105!, 6001!), Mandor (Nos. 3481!, 3489!, 3490!, 3491!), Kailana (Nos. 3496!, 3497!, 3498!, 3500!), Balarwa (Nos. 6009!, 3499!). Jaisalmer: Between Phalodi and Bap (Nos. 3479!, 3486!, 3487!, 3488!). Jaisalmer (Nos. 6006!, 3494!), N. of Jaisalmer (No. 6008!), Amarsagar (Nos. 3411!, 3410!, 3426!, 3425!), Bada Bag (Nos. 3495!, 3493! 6106!, 6007!, 6005!, 3428!, 3427!), Vinjorai (Nos. 6004!, 6003!, 3482!, 3483!, 3484!, 3485!, 3492!), Devikot (Nos. 5996!, 6002!).



A.—Crest of a dune East of Loharki (Jaisalmer State). On top: *Calligonum polygonoides.* On the slope: *Rhynchosia arenaria*, *Aerua pseudo-tomentosa*, *Indigofera argentea.*



B.—The same dune as above, seen from the plain. Part of the advancing wind-eroded crest is shown on Plate I-A.

Distrib.: Africa, S. and E. Asia, Australia, Europe (where it is probably introduced).
Fl. and fr. in October and November.

Ammania multiflora, Roxb. Fl. Ind. I (1820) 447.
Loc.: Jodhpur: Kailana (Nos. 3385 !, 3384 !), Balarwa (No. 3386 !), near Kotda (No. 3390 !), Jaisalmer: Vinjorai (No. 3389 !), near Devikot (Nos. 3388 !, 3387 !).
Distrib.: Trop. Africa, Madagascar, Asia: Persia, Kurdistan, Afghanistan, India, Andamans to the Philippines and Japan, Australia: N. W. and S. Australia, Victoria, New S. Wales, Queensland.
Fl. and fr. in October and November.

Ammannia desertorum, Blatt. and Hall. in Journ. Bomb. Nat. Hist. Soc. XXV (1918) 213.
Loc.: Jodhpur: Kotda near Seu (No. 3345 !), near Badka on wet ground (Nos. 3346 !, 3347 !). Jaisalmer: Devikot (No. 3341 !), near Devikot (Nos. 3342 !, 3343 !), Vinjorai (No. 3344 !).
Fl. and fr. in November.

Punica L.

Punica granatum, L. Sp. Pl. (1753) 472.—The pomegranate.
Vern. N.: Anar.
Loc.: Jodhpur. Jaisalmer: Bada Bag (No. 6747 !).
NOTE: The Jodhpur variety is celebrated for its delicate flavour (Erskine).

Lawsonia L.

Lawsonia inermis, L. Sp. Pl. (1753) 349.
Loc.: Jodhpur: Jodhpur (No. 7315!). Jaisalmer: Amarsagar (No. 6748 !).

SAXIFRAGACEÆ.

Vahlia Thunb.

Vahlia viscosa, Roxb. Fl. Ind. II (1832) 89.
Vern. N.: Noli (Macadam).
Loc.: In rocky dry places of Jodhpur and Jaisalmer, not very common.
Distrib.: India, Persia, Egypt, Trop. Africa.
Fl. in December.

ONAGRACEÆ.

Trapa L.

Trapa bispinosa, Roxb. Hort. Beng. (1814) 11.
Loc.: Jodhpur: Balsamand (No. 6750 !). Not seen anywhere else.
Distrib.: Trop. Africa, Indo-Malaya.
Fr. in October.

CUCURBITACEÆ.

Momordica L.

Momordica charantia, L. Sp. Pl. (1753) 1009.
Vern. N.: Karela.
Loc.: Jodhpur: Kailana (No. 6661!). Jaisalmer: Not uncommon in cultivated places (Macadam).
Distrib.: Trop. Africa, Indo-Malaya.
Fr. in October.
Uses: The fruit when green is cooked and eaten (Macadam).

Momordica balsamina, L. Sp. Pl. (1753) 1009.
Loc.: Jodhpur : Mandor (6660 !).
Distrib.: Africa, W. Asia, Indo-Malaya, Australia.
Fl. and fr. in October.

Momordica dioica, Roxb. in Willd. Sp. Pl. IV (1805) 605.
Loc.: Jaisalmer: Jaisalmer, sand (No. 6659 !), Bada Bag (No. 6658 !).
Distrib.: Indo-Malaya.
Fr. in November.

Luffa Cav.

Luffa aegyptiaca Mill. Dict. ed. 8 (1768).
Loc.: Jodhpur: Bhikamkor (No. 6655!) Jaisalmer: Bada Bag (No. 6656 !).
Fl. in October and November.

Luffa acutangula, Roxb. Hort. Beng. (1814) 70.
Loc.: Jaisalmer: Amarsagar (No. 6657!). Jodhpur: Balarwa (Nos. 6709 !, 6671 !).
Fl. in November.

Cucumis L.

Cucumis trigonus, Roxb. Hort. Beng. (1814) 70.
Vern. N.: Kachri (Macadam).
Loc.: Jodhpur: Osian (No. 6654 !), Balarwa (No. 6701 !), Balsamand (No. 6653 !), Mandor (No. 6647 !), Phalodi (No. 6648 !). Jaisalmer: Vinjorai (No. 6652 !), Devikot (Nos. 6649 !, 6651 !), Loharki (No. 6700 !), Sodakoer (No. 6650 !), not uncommon in fields and cultivated places, in large quantities between Dabla and Jaisalmer (Macadam.)
Distrib: Persia, Afghanistan, Indo-Malaya, N. Australia.
Fl. and fr. in October and November.
Uses: Fr. eaten.

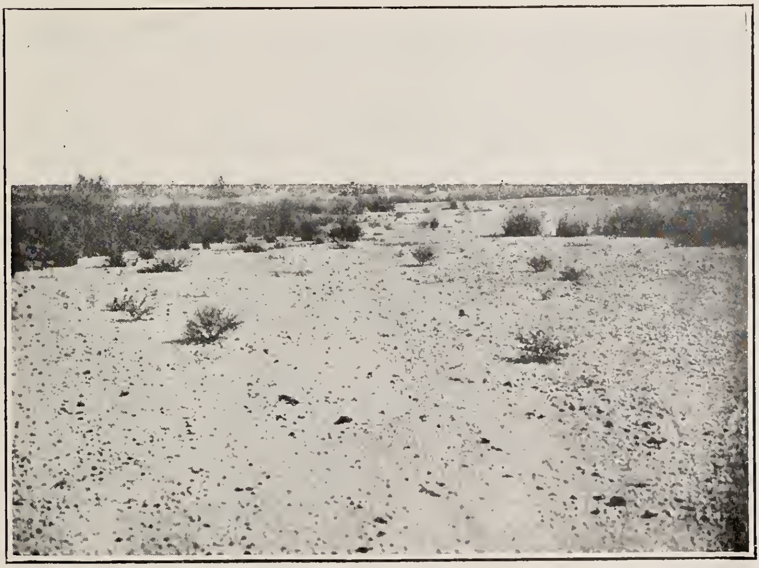
Cucumis melo, L. Sp. Pl. (1753) 1011, *var. agrestis*, Naud. in Ann. Sci. Nat. ser. 4, XI (1859) 73 and XII, 110.
Loc.: Jodhpur: Kailana (No. 6640 !), Osian (No. 6646 !), Barmer (No. 6612 !), Phalodi (No. 6643 !), Jaisalmer: Vinjorai (No. 6636 !), Amarsagar (No. 6637 !), Jaisalmer, sand (No. 6638 !), near Devikot (No. 6639 !), Vinjorai wet ground (No. 6641 !), near Bap (No. 6644 !), near Loharki (No. 6714 !).
Fl. in October and December.

Cucumis prophetarum, L. Cent. Amoen. Acad. IV (1759) 295.
Loc.: Jaisalmer: Devikot (Nos. 6635 !, 6634 !), Amarsasar (No. 6669 !).
Distrib.: Trop. Africa, Arabia, Baluchistan, Sind, Rajputana.
Fl. and fr. in November.

Citrullus Neck.

Citrullus colocynthis, Schrad. in Linnaea XII (1838) 414.
Vern. N.: Tastumba, Tumba.
Loc.: Jodhpur: Jodhpur (No. 6624 !), Balarwa (No. 6706 !), Kailana (No. 6704 !), Phalodi (No. 6627 !), Osian (No. 6633 !), Mandor (No. 6630 !), Bhikamkor (No. 6626 !), near Badka (No. 6622 !), Barmer (No. 6623 !), Jaisalmer: near Devikot (No. 6625 !), Vinjorai (No. 6629 !), Jaisalmer, rocky plateau (Nos. 6631 !, 6632 !), Sodakoer, riverbed (No. 6628 !), Amarsagar (No. 6705 !), Loharki (No. 6703 !), very frequent in sandy places between Balotra and Jaisalmer, particularly between Utarni and Undu where large patches of ground are often thickly covered with the fruit (Macadam).

A.—View of gravel plain, from the top of dune in Plate XIII showing bare patches. In the fore-ground, at foot of dune: *Aerua tomentosa*, *Crotalaria burhia*.



B.—Bare area in the above locality, colonized by *Cleome papillosa*, *Fagonia cretica*, *Boerhaavia diffusa*, and *Leptadenia spartium*.

Distrib: Mediterranean region, W. Asia, Arabia, India, Ceylon.
Fl. and fr. in October and November.
Uses : The seeds are ground and made into cakes by the very poor (Macadam).

Citrullus vulgaris, Schrad.—The Water Melon.
Loc. · Cultivated in both states. Growing even in the poorest soil, called 'baikal' which is a light sand having little or no earthy admixture. (Adams).
Distrib. : Indigenous in tropical Africa, extensively cultivated in most warm countries.
Uses : The pulp is eaten fresh, the seeds are dried, ground and mixed with flour for food. There is a large import of fruit into some of the towns in Jodhpur. (Adams.)

Coccinia Wight & Arn.

Coccinia indica, Wight & Arn. Prodr. (1834) 347
Vern. N.: Jungli Karela, goleda.
Loc. : Jodhpur : Barmer (No. 6617 !), Bhikamkor (No. 6693 !), near Badka (No. 6621 !) Jaisalmer : near Bap (No. 6615 !), Bada Bag, near Jaisalmer (No. 6618 !), Amarsagar (Nos. 6619 !, 6694 !), Vinjorai (No. 6620 !), Devikot (No. 1616 !).
Distrib. : Trop. Africa, Indo-Malaya.
Fl. in November.

Melothria L.

Melothria leiosperma, Cogn. in DC. Monogr. Phan. III (1881) 622.
Loc. : Jodhpur : Bhikamkor (No. 6603 !), Jaisalmer : Bada Bag (No. 6695 !), Sodakoer (No. 6602 !), Loharki (No. 6696 !).
Distrib. : India, Ceylon.
Fl. in November.

Melothria maderaspatana, Cogn. in DC. Monogr. Phan. III (881) 623.
Vern. N.: Ak phutni vel.
Loc. : Jodhpur : Jodhpur (No. 6605 !), Bhikamkor (No. 6702 !), Mandor (No. 6606 !), Osian (No. 6697 !), Balsamand (No. 6610 !), Barmer (No. 6699), Phalodi (No. 6609 !), Jaisalmer : Sodakoer (No. 6611 !), Loharki (Nos. 5922 !, 6698 !), Vinjorai dunes (No. 6607 !), near Bap (No. 6612 !).
Distrib. : Trop. Africa, Indo-Malaya, Australia.
Fl. and fr. in October and November.

Melothria perpusilla, Cogn. in DC. Monogr. Phan. III (1881) 607.
Loc. : Jaisalmer : Vinjorai (No. 6614 !), Shihad (No. 6613 !), Jodhpur : Jodhpur (No. 6708 !).
Distrib. : Africa, Indo-Malaya.
Fr. in November.

Melothria heterophylla, Cogn. in DC. Monogr. Phan. III (1881) 618.
Loc. : Jodhpur : Mandor (No. 6604 !).
Distrib. : India, Ceylon, China, Cochin China, Java.

Blastania Kotschy & Peyr.

Blastania fimbristipula, Kotschy & Peyr. Pl. Tinn. (1865-1866) 15, t. 7.
Loc. : Jaisalmer : Bada Bag (No. 6601 !).
Distrib. : Trop. and S. Africa, Arabia, Sind, Rajputaua, Gujarat.
Fl. in November.

Corallocarpus Welw.

Corallocarpus epigæus, C. B. Clarke in Hook. f. Fl. Brit. Ind. II (1879) 628.

Vern. N.: Karela.

Loc.: Jodhpur: Barmer, sand (No. 6599 !), near Kotda (No. 6600 !), Osian (No. 6707 !).

Distrib.: India, Ceylon.

Cucurbita L.

Cucurbita maxima, Duchesne.

Loc.: Jaisalmer: Amarsagar (No. 6670 !).

CACTACEÆ.

Opuntia Tourn.

Opuntia dillenii, Haw.—The Prickly Pear.

Vern. N.: Nagphani (nagphani means snake-hooded and refers to the shape of the leaves (Macadam).

Loc.: Jodhpur and Jaisalmer States; often found in dry rocky places near villages (Macadam).

Used for fences.

FICOIDEÆ.

Trianthema L.

Trianthema monogyna, L. Mantiss. (1767) 69.

Vern. N.: Safed santer, Sarta (Macadam), Hata.

Loc.: Jodhpur: Mandor (No. 6753 !), Seu (No. 6755 !), Jaisalmer: Vinjorai, sandy plain (No. 6754 !), Jaisalmer (No. 6751 !), Shihad (No. 6752 !), very frequent in gardens and cultivated places (Macadam).

Distrib.: Most tropical regions.

Fl. and fr. in October and November.

NOTE: Cap of fruit containing two seeds, truncate, slightly mitriform, oblique, with a raised margin, higher on one side.; mouth closed (downwards) by a thin membrane. Lower part of capsule containing 3-5 seeds.

Trianthema triquetra, Rottl. & Willd. in Gesellsch. Naturf. Fr. neue Schr. IV (1803) 181.

Vern. N.: Lunki.

Loc.: Jodhpur: Jodhpur (Nos. 6756 !, 6769 !), Phalodi (No. 6764 !). Jaisalmer: Bap (Nos. 6761 !, 6757 !), Jaisalmer (No. 6766 !), Jaisalmer, on sand (No. 6762 !), Amarsagar (No. 6758 !), Vinjorai (Nos. 6760 !, 6765 !), Vinjorai, on gravel (No. 6767 !), Vinjorai, sandy plain (No. 6768 !), Devikot (Nos. 6763 !, 6759 !).

Distrib.: India, Ceylon.

Fl. and fr. in October and November.

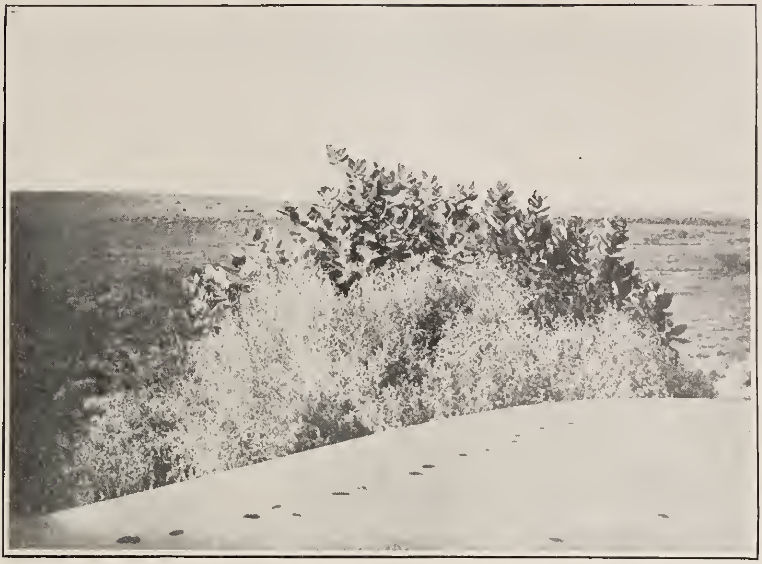
NOTE: Trimen, in his Fl. of Ceylon II, 269, makes the variety *Rottleri*, which cannot be retained, as the only character of importance, *viz.*, the folding of the calyx-teeth "over top of ripe capsule" is not constant. Our specimen No. 6760 combines the characters of the type and of Trimen's variety.

Trianthema pentandra, L. Mantiss. (1767) 70.

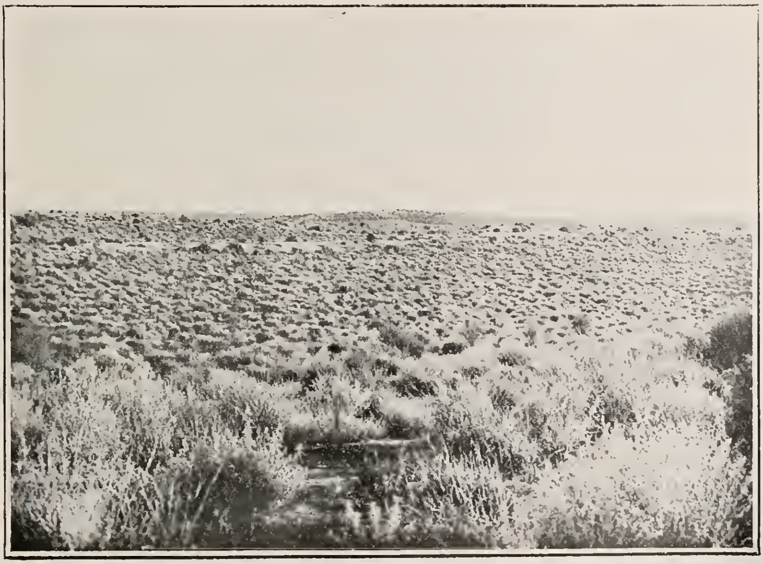
Vern. N.: Santer, Sarta.

This species, is represented by the following varieties:—

Var. a rubra var. nov.—Fructus maturus ruber.



A.—Edge of sand-dune at Loharki, Jaisalmer State (the same as on Plate II) with a clump of *Calotropis procera, Aerua tomentosa, Leptadenia spartium*, and *Panicum turgidum*.



B.—Elevated dune area at Loharki with *Crotalaria burhia, Leptadenia spartium, Aerua pseudo-tomentosa*, and *Panicum turgidum*.

Loc. : Jodhpur : Jodhpur (Nos. 6774 !, 6777 !), Balarwa (No. 6778 !), Bhikamkor (Nos. 6780 !, 6782 !), Phalodi, on gravel (No. 6783 !), Barmer, on gravel (No. 6770 !), Jaisalmer : Phalodi to Bap (No. 6775 !), Sodakoer (No. 6784 !), Loharki, on dunes and gravel (No. 6773 !), Shihad (Nos. 6787 !, 6772 !), Jaisalmer (No. 6776 !), Amarsagar (No. 6771 !), Vinjorai, on dunes (Nos. 6786 !, 6785 !).

Var. β flava, var. nov.—Fructus maturus flavus.

Loc. : Jaisalmer : Jaisalmer (Nos. 6788 !, 6789 !).

This variety seems to be rare, whilst the other is very common, especially in gardens and cultivated places.

Distrib. of the species : India, Trop. Africa.

Fl. and fr. in October and November.

Trianthema hydaspica, Edgew. in Journ. Linn. Soc. VI (1862) 203.

Loc. : Jodhpur : Seu, wet ground (No. 6797 !). Jaisalmer : Bap, gravel (Nos. 6792 !, 6793 !), Amarsagar (No. 6796 !), Jaisalmer (No. 6798 !), near Devikot (No. 6794 !), Devikot (Nos. 6790 !, 6791 !, 6795 !), Vinjorai (No. 6799 !).

Distrib. : India, Trop. Africa.

Fl. and fr. in October and November.

Orygia Forsk.

Orygia decumbens, Forsk. Fl. Aegypt. Arab. (1775) 103.

Loc. : Jodhpur : Mandor, on rocks (No. 6802 !), Kailana, on rocks (Nos. 6801 !, 6808 !, 6811 !, 6812 !), Kotda near Seu (No. 6804 !), Barmer on rocks (Nos. 6806 !, 6809 !). Jaisalmer : Bada Bag (Nos. 6800 !, 6805 !), N. of Jaisalmer on rocks (No. 6807 !), Vinjorai on rocks (No. 6803 !).

Distrib. : India, W. Asia, Africa.

Fl. and fr. in October and November.

Mollugo L.

Mollugo hirta, Thunb. Prodr. Pl. Cap. (1794) 24.

Vern. N. : Bakda, Matter (Macadam), Hata.

Loc. : Jodhpur : Badka (No. 6813 !), Barmer (Nos. 6117 !, 6821 !), Jaisalmer : Jaisalmer (Nos. 6814 !, 6820 !), 15 miles E. of Jaisalmer (No. 6822 !), N. of Jaisalmer (No. 6819 !), Sodakoer (No. 6818 !), Devikot, gravel (No. 6815 !), Vinjorai (No. 6816 !), rather frequent in cultivated places of Jodhpur and Jaisalmer (Macadam).

Distrib.: Warmer regions of the world.

Fl. and fr. in November.

Uses: Used as a cure for indigestion.

Mollugo nudicaulis, Lam. Dict. IV, 234.

Vern. N.: Ragatia khar.

Loc.: Jodhpur : Kailana (Nos. 6850 !, 6851 !), Balsamand (No. 6848 !), Mandor (No. 6847 !), Balarwa (No. 6852 !), near Badka (No. 6846 !), Jaisalmer : Devikot (No. 6849 !).

Distrib : Tropical Africa, India, New Caledonia, Cuba.

Fl. and fr. in October and November.

Uses. : Applied externally against ulcers.

Mollugo cerviana, Seringe in DC. Prodr. I (1824) 392.

Loc. : Jodhpur : Bhikamkor (No. 6854 !), Balarwa (Nos. 6855 !, 6856 !), Phalodi (No 6862 !), Barmer, sand (No. 6859 !), near Badka (No. 6853 !), Loharki (No. 6858 !), 10 miles W. of Bap (No. 6866 !), Jaisalmer, sand (Nos. 6864 !, 6865 !), (Devikot No. 6860 !), Vinjorai, dunes (Nos. 6863 ! , 6867 !).

Distrib. : Trop. Africa, India, Ceylon, Australia.

Fl. and Fr. in October and November.

Gisekia L.

Gisekia pharnaceoides, L. Mantiss. (1771) 562.
Vern. N.: Morang (Macadam), Sareli.
Loc.: Jodhpur: Judhpur (No. 6826 !), Osian (No. 6828 !), Bhikamkor (No. 6827 !), near Badka (No. 6825 !), Barmer (No. 6833 !), Jaisalmer: Jaisalmer, sand (Nos. 6832 !, 6830 !, 6824 !), Sodakoer, sand (No. 6823 !), near Loharki, sand (Nos. 6829 !, 6834 !), Vinjorai (No. 6831 !), near Devikot (No. 4824 !).
Distrib.: India, Baluchistan, Afghanistan, Africa.
Fl. and fr. in October and November.
Uses: Eaten by camels.

Limeum L.

Limeum indicum, Stocks ex T. Anders. in Journ. Linn. Soc. V, Suppl. 1 (1860) 30.
Vern. N.: Shapari.
Loc.: Jodhpur: Phalodi (Nos. 6842 !, 6843 !), Jaisalmer: Bap, gravel (No. 6838 !), 10 miles W. of Bap (No. 6836 !), Loharki (No. 6837 !), Amarsagar (No. 6835 !), Jaisalmer, gravel (Nos. 6839 !, 6840 !), Sodakoer (No. 6844 !), Devikot (No. 6841 !), Vinjorai, sandy plain (No. 6845 !).
Distrib.: India, Baluchistan, Arabia, Nubia.
Fl. and fr. in October and November.

UMBELLIFERÆ.

Peucedanum L.

Peucedanum graveolens, Benth. & Hook. f. Gen. Pl. I, 919.—The Dill.
Loc.: Judhpur: Marwar Junction, run wild (No. 6744 !).

RUBIACEÆ.

Mitragyna Korth.

Mitragyna parvifolia, Korth. Obs. Naucl. Ind. (1839) 19.
Loc.: Jaisalmer: Amarsagar (No. 7083 !), probably cultivated.
Distrib.: India, Ceylon.
Fr. in November.

Oldenlandia L.

Oldenlandia aspera, DC. Prodr. IV (1830) 428.
Vern. N.: Danakar.
Loc.: Jodhpur: Kailana (Nos. 7092 !, 7090 !), Balsamand (No. 7089 !), Balarwa (No. 7091 !), Bhikamkor (No. 7096 !), Phalodi (No. 7098 !) near Badka (No. 7086 !). Jaisalmer: Amarsagar (No. 7093 !), Jaisalmer, plateau (No. 4131 !), 10 miles W. of Bap (No. 7088 !), between Phalodi and Bap (No. 7085 !), Shihad (No. 7087 !), near Loharki (No. 7097 !), near Devikot (No. 7084 !), Devikot (No. 7094 !), Vinjorai, sandy plain (No. 7095 !).
Distrib.: India.
Fl. and fr. in October and November.

Spermacoce L.

Spermacoce stricta, L. f. Suppl. (1781) 120.
Loc.: Jodhpur: Balarwa (Nos. 7100 !, 7099 !), rare in Rajputana.
Distrib.: Trop. Africa and Asia.
Fl. and fr. in October.
NOTE: The floral leaves are much more numerous than given by Cooke.

Spermacoce hispida, L. Sp. Pl. (1753) 102.

A.—In the neighbourhood of Kailana (Jodhpur State). A clump of *Leptadenia spartium* and ***Aerua tomentosa.***

B.—Near Kailana: *Leptadenia spartium* supporting *Launæa chondrilloides.*

Loc.: Jodhpur (Nos. 7101!, 7102!), Kailana (No. 7108!), Mandor (No. 7105!), Osian (No. 7107!), Balarwa (Nos. 7108!, 7103!), Bhikamkor (No. 7104!). Not found in Jaisalmer State.
Distrib.: Indo-Malaya.
Fl. and fr. in October and November.
NOTE: The capsule does not open in the manner described by Hooker (Fl. Brit. Ind. III, 200) and Cooke (Fl. Bomb. Pres. I, 624). The capsule has finally the appearance of two spreading valves with the scarious septum between them. This septum, however, consists of two lamellæ, easily separable from each other. After the two mericarps have separated, the one which dehisces first, remains open, whils its lamella, on account of its elasticity, is thrown back on the closed mericarp and remains in that position till this mericarp also opens.

COMPOSITÆ.

Vernonia Schreb.

Vernonia cinerea, Less. in Linnæa IV (1829) 291.
Loc.: Jodhpur: Jodhpur (Nos. 10007!, 10013!), Balsamand (No. 10011!), Mandor (Nos. 10012!, 10008!), Barmer (No 10015!), near Badka (No. 10009!).
Jaisalmer: Jaisalmer (No. 10010!), Amarsagar (No. 10014!).
Distrib.: Tropics of the Old World.
Fl. and fr. in October and November.

Vernonia cinerascens, Schultz.-Bip. in Schweinf. Fl. Aethiop. (1867) 162.
Loc.: Jodhpur: Kailana (No. 10001!), Barmer (No. 10002!), Kotda near Seu (No. 10004!). Jaisalmer: N. of Jaisalmer (No. 20003!), Jaisalmer on rocks (No. 10005!), Vinjorai (No. 10006!).
Distrib.: India, Baluchistan, Trop. Africa.
Fl. and fr. in October and November.
NOTE: There are several discrepancies between the descriptions in Cooke's Fl. Bomb. Pres. and Hook. f.'s Fl. Brit. Ind. Our specimens agree with Hooker's diagnosis.

Ageratum L.

Ageratum conyzoides, L. Sp. Pl. (1753) 839.
Loc.: Jodhpur: Balarwa (No. 10017!). Jaisalmer: Vinjorai, sand (No. 10016!), Amarsagar (No. 10018!), Bada Bag (No. 10019!).
Distrib.: All hot countries.
Fl. and fr. in October and November.

Blumea DC.

Blumea amplectens, DC. in Wight Contrib. (1834) 13.
Loc.: Jodhpur: Balsamand (No. 10020!), Jodhpur (No. 10021!), Kailana (No. 10022!).
Distrib.: India, Ceylon.
Fl. and fr. in October.

Cyathocline Cass.

Cyathocline lyrata, Cass. in Ann. Sc. Nat. ser 1, XVII (1829) 420.
Loc.: W. Rajputana, near irrigated spots (King).
Distrib.: India.

Pluchea Cass.

Pluchea lanceolata, C. B. Clarke Comp. Ind. (1876) 94.
Loc.: W. Rajputana (King).
Distrib.: India, Afghanistan, N. Africa.

Sphæranthus L.

Sphæranthus indicus, L. Sp. Pl. (1753) 927.
Loc.: W. Rajputana (King).
Distrib.: Africa, Indo-Malaya, Australia.

Cæsulia Roxb.

Cæsulia axillaris, Roxb. Hort. Beng. (1814) 62.
Loc.: Jodhpur: 25 miles S. E. of Luni (No. 10024 !).
Distrib.: India, Ceylon.
Fl. in November.

Gnaphalium L.

Gnaphalium pulvinatum, Del. Fl. Aegypt. 122, t. 44, f. 1.
Loc.: Jaisalmer: N. of Jaisalmer (No. 10025 !), on wet ground.
Distrib.: India, Egypt.
Fl. in November.

Pegolettia Cass.

Pegolettia senegalensis, Cass. in Dict. Sc. Nat. XXXVIII, 232.
Loc.: Jodhpur: Mandor (No. 10029 !), Kailana (Nos. 10026!. 10032 !), Kotda near Sen (No. 10033 !), Barmer, on rocks (Nos. 10031!, 10036 !). Jaisalmer: Jaisalmer, on rocky plateau (Nos. 10027 !, 10037 !), Jaisalmer, sand (No. 10034 !), Amarsagar (No. 10035 !), Vinjorai, sandy plain (No. 10028 !).
Distrib.: Trop. Africa, Cape Verde Islands, Trop. Arabia, Rajputana.
Fl. and fr. in October and November.
Note: The Flora of Trop. Africa mentions this plant as occurring in Sind; but, to our knowledge, no Indian Flora has ever noted this genus.

Vicoa Cass.

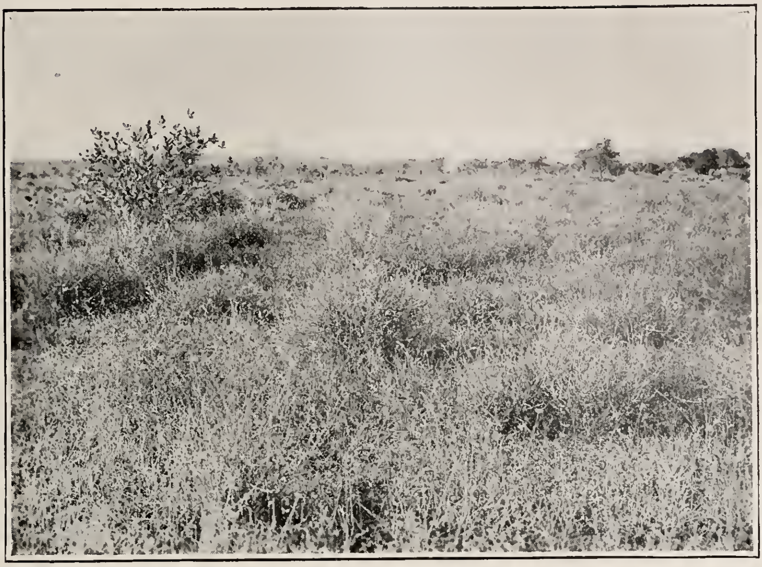
Vicoa auriculata, Cass. in Ann. Sc. Nat. ser. 1, XVII (1829) 418.
Loc.: Jodhpur: Jodhpur (No. 10038 !), 25 miles S. E. of Luni (No. 10030 !).
Distrib.: India, Ceylon.
Fl. in October and November.

Pulicaria Gaertn.

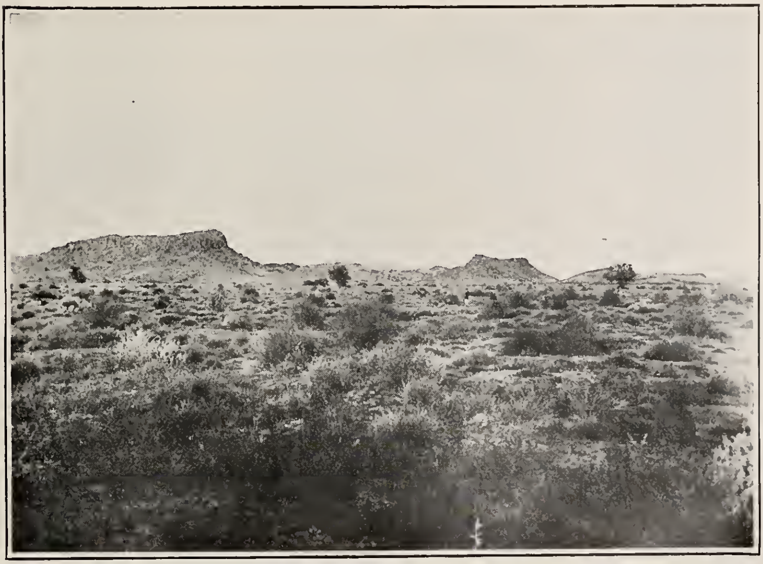
Pulicaria crispa, Benth. in Gen. Pl. II, 336.
Vern. N.: Dhola lizru (Macadam).
Loc.: Jaisalmer: Vinjorai, sandy plain (Nos. 10042 !, 10041 !), Jodhpur, not very common (Macadam).
Distrib.: India to Arabia, Trop. Africa, Cape Verde Islands.
Fl. in November.
Uses: The bruised leaves are applied to the head to relieve headache (Macadam).

Pulicaria angustifolia, DC. Prodr. V, 479.
Vern. N.: Soneli (Macadam).
Loc.: Jodhpur: Kailana (No. 10068 !), Mandor (No. 10066 !), near Badka, sand (No. 10070 !), Jaisalmer: Bap (No. 10069 !), Sodakoer, dried up river bed (No. 10071 !), Vinjorai, dunes (No. 10065 !).
Distrib.: India, Baluchistan.
Fl. and fr. in October and November.

Pulicaria wightiana, C. B. Clarke, Comp. Ind. 118.
Vern. N.: Sonela.



A.—Along the road from Jodhpur to Balsamand : *Crotalaria burhia* and *Aerua tomentosa* with isolated individuals of *Calotropis procera* ; in the background *Prosopis spicigera*.



B.—On the road between Jodhpur and Kailana : *Crotalaria burhia*, *Aerua tomentosa*, and *Leptadenia spartium*.

Loc. : Jodhpur: Jodhpur (No. 10063 !), Kailana (No. 10056 !), Mandor (No. 10062 !), Osian (Nos. 10055 !, 10057 !), Balarwa (No. 10067 !), Phalodi (No. 10061 !), Barmer (No. 10059 !). Jaisalmer: Between Phalodi and Bap (No. 10056 !), near Bap (No. 10060 !).

Distrib. : India.

Fl. and fr. in October and November.

Pulicaria rajputanæ spec. nov.

Suffrutex perennis, foliosus, bipedalis, partibus omnibus, exceptis capitulis dense albo-lanatis, parte inferiore lignoso, interdum glabrescente; rami virgati. Folia 6 cm. attingentia, alterna, sessilia, linearia-oblonga vel sub-spathulata, besi auriculata., semiamplexicaulia (margine non recurvato), serrata vel irregulariter dentata vel sinuato-dentata.

Capitula generatim pauca, circa 8 mm. diametro, ad apices ramorum solitaria, heterogama; involucrum hemisphæricum, pubescens; bracteæ pluriseriatæ, graciles, setaceæ, acuminatæ, exteriores breviores. Receptaculum convexiusculum, foveolatum. Corollæ femineæ ligulatæ, flavæ patentes, bracteis longiores, hermaphroditæ pappo æquilongæ.

Pappus duplex: exterior paleis brevissimis in cupulam minimam laceram cum interiore connatis, interior setis pluribus barbellatis, incrassatis versus apicem; setæ 6-plo longiores achæniis. Achænia glabra.

This species is nearly related to *P. crispa*, Benth. It differs in the following points: The plant is woolly all over; the margin of the leaves is not recurved; the ligules are much longer than the bracts; the pappus is six times as long as the achenes.

Loc. : Jodhpur: Kailana (Nos. 10043 ! 10044 !), Mandor (Nos.10050 !, 10051 !), Balsamand (No. 10039 !), near Badka (No. 10046 !), Jaisalmer: Between Phalodi and Bap (No. 10047 !), near Jaisalmer (No. 10045 !), near Devikot (No. 10048 !), Vinjorai (Nos. 10049 !, 10052 !, 10053 !).

Fl. and fr. in October and November.

Lagasca Cav.

Lagasca mollis, Cav. in Anal. Cienc. Nat. VI (1803) 332.

Loc. : Jodhpur: Jodhpur (No. 10054 !).

Distrib. : Central America ; a weed of cultivation in many parts of India.

Fl. and fr. in October.

Eclipta L.

Eclipta erecta, L. Mantiss. II (1771) 286.

Vern. N. : Jal bangra (Macadam).

Loc. : Jodhpur: Balsamand (No. 10077 !), Barmer (No. 10073 !), Jaisalmer: Between Phalodi and Bap. (No. 10072 !), Bap (No. 10078 !), Amarsgar (No. 10074 !), Jaisalmer (No. 10079 !), Vinjorai, near tank (No. 10076 !), Devikot wet ground (No. 10075 !).

Distrib.: Cosmopolitan in warm countries.

Fl. and fr. in October and November.

Blainvillea Cass.

Blainvillea rhomboidea, Cass. in Dict. Sc. Nat. XXIX (1823) 494.

Loc. : Jodhpur: Kailana (No. 10080 !), Balarwa (No. 10082 !). Jaisalmer: Bada Bag (No. 10081 !).

Distrib. : Africa, Indo-Malaya, Australia, America.

Fr. in October and November.

Wedelia Jacq.

Wedelia urticæfolia, DC. in Wight Contrib. 18.
Loc.: Jaisalmer: Jaisalmer (No. 10144 !).
Distrib.: Indo-Malaya.
Fl. in November.

Glossocardia Cass.

Glossocardia setosa, spec. nov.

Herba basi lignosa, diffusa vel erecta, ramosissima, 45 cm. attingens. Folia alterna, tenuia, semel vel bis pinnatisecta segmentis linearibus apiculatis.

Capitula parva, 10 mm. longa, pedunculata, terminalia vel axillaria, numerosissima. Involucrum oblongum; bracteæ exteriores generatim 3, inæquales, omnes margine lato, scarioso, laceratiusculo, maxima late ovata, 3 mm. longa et ceteris latior, apice obtusa, in parte non scariosa brunneo-viridis; ceteræ late ovatæ repente acuminatæ cuspidatæ, costa in dorso prominente, brunneo-virdi. Bracteæ interiores 3-5, inæquales (maximæ circa 6 mm. longæ, 2-2½ mm. latæ), oblongæ, obtusæ, striatæ, glabræ, brunneæ, marginibus albis scariosis. Receptaculum parvum convexiusculum, foveolatum, paleis paucis planis.

Achænia 8-9 mm. longa, nigro-brunnea, linearia-oblonga, attenuata utrimque, magis versus basim, a dorso plano-compressa, marginibus patenter longeque setosis, ad facies linea longitudinali adpresse setosa, aristis duobus fere horizontalibus ad apicem adscendentibus, 3 mm. longis setosis coronata.

The following characters distinguish this species from *Glossocardia linearifolia* Cass.:—

The plant is much larger and generally erect, the shape of the outer bracts is different, the awns of the achene spread almost horizontally and are setose, sometimes half way up, at other times along their whole length.

Loc.: Jodhpur: Kailana (No. 10083!), Balsamand (No. 10085!). Jaisalmer: Bada Bag (Nos. 10086!, 10084!).
Fr. in October and November.

Bidens L.

Bidens pilosa, L. Sp. Pl. (1753) 832.
Loc.: Jodhpur: Kailana (No. 10145 !), a very rare plant in Rajputana.
Distrib. Most warm countries.
Fl. and fr. in October.

Tridax L.

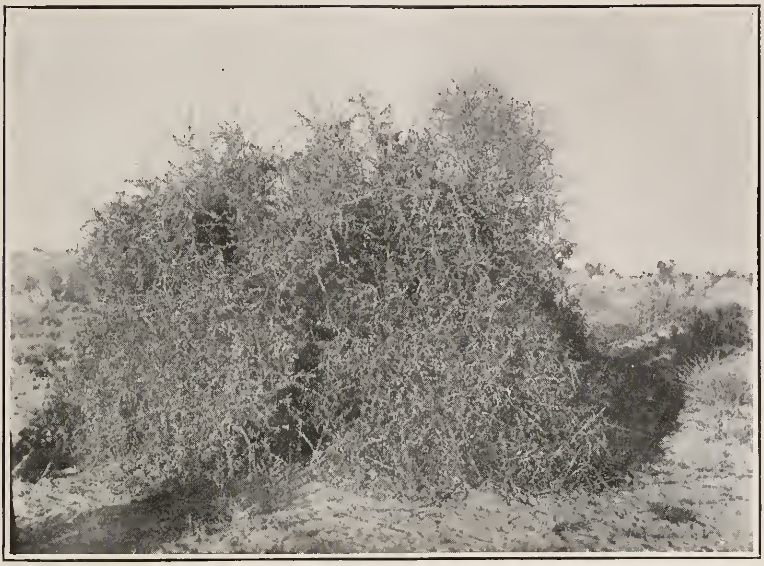
Tridax procumbens, L. Sp. Pl. (1753) 900.
Loc.: Jodhpur: Jodhpur (No. 2951 !), very rare in Rajputana.
Distrib.: Central America, naturalized in India.
Fr. in October.

Chrysanthemum L.

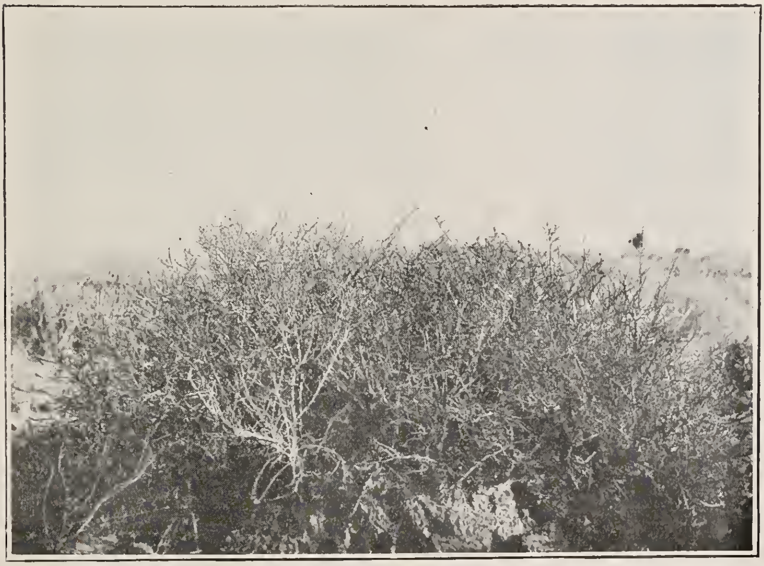
Chrysanthemum indicum, L. Sp. Pl. (1753) 889.
Loc.: Jaisalmer: Amarsagar, in garden (No. 10088 !).
Distrib.: China and Japan, grown in Indian gardens.

Cotula L.

Cotula hemisphærica, Wall. Cat. 3236.
Loc.: W. Rajputana near irrigated spots (King).
Distrib.: India, China.



A.—Clump of *Lycium barbarum* and *Capparis decidua* in a sandy plain near Devikot (Jaisalmer State).



B.—Shoot-habit of *Haloxylon salicornicum.* The plant protects the small mound on which it grows against erosion. Taken East of Sodakoer (Jaisalmer State).

Echinops L.

Echinops echinatus, DC. in Wight Contrib. 24.

Loc.: Jodhpur: Mandor (Nos. 10090 !, 10091 !), near Badka (No. 10092 !). Jaisalmer: Vinjorai (No. 10089 !).

Distrib.: India, Afghanistan.

Fl. and fr. in October.

Note: We have noted specimens with blue and lilac flowers.

Tricholepis DC

Tricholepis radicans, DC. Prodr. VI (1837) 564.

Loc.: W. Rajputana (King).

Distrib.: India.

Volutarella Cass.

Volutarella divaricata, Benth. and Hook. f. in Gen. Pl. II. (1873) 476.

Loc.: Jodhpur: In cultivated places about Jodhpur, not very common (Macadam), Mandor (No. 10100 !). Balsamand (No. 10097 !), Balarwa (No. 10102 !), Bhikamkor (No. 10094 !), Phalodi (No. 10103 !), Barmer, sand (No. 10104 !). Jaisalmer: Between Phalodi and Bap (Nos. 100951 !, 10096 !), near Bap (No. 10098 !), near Loharki (No. 10093 !), Jaisalmer, sand (No. 10101 !), Vinjorai, sandy plain (No. 10099 !).

Distrib.: India, Afghanistan, Baluchistan.

Fl. and fr. in October and November.

Uses: Said to be a powerful purgative (Macadam).

Dicoma Cass.

Dicoma tomentosa, Cass. in Bull. Soc. Philom. (1818) 47.

Vern. N.: Vajradanti.

Loc.: Jodhpur: Kailana (Nos. 10111 !, 10109 !), Bhikamkor (No. 10108 !), Osian (No. 10115 !), Barmer (No. 10113 !), near Badka (No. 10117 !), Kotda near Seu, on rocks (No. 10118 !). Jaisalmer: Near Bap (No. 10116 !), Amarsagar (10107 !), Bada Bag (No. 10106 !), Jaisalmer, rocky plateau (Nos. 10110 !, 10105 !), Vinjorai. gravel (No. 10114 !), Vinjorai, dunes (No. 10112 !).

Distrib.: Trop. Africa, India.

Fl. and fr. in October and November.

Uses: The roots are used as tooth-brushes.

Lactuca L.

Lactuca runcinata, DC. in Wight Contrib. (1834) 246.

Loc.: Jodhpur Fort (No. 10119 !).

Distrib.: India, Ceylon.

Fl. in October.

Lactuca remotiflora, DC. in Wight Contrib. (1834) 26.

Loc.: Jodhpur: Jodhpur (No. 10121 !), Balsamand (No. 10087 !), Barmer (No. 10120 !).

Distrib.: India, Arabia.

Fl. and fr. in October and November.

Sonchus L.

Sonchus asper, Hill. Herb. Brit. I (1769) 47.

Loc.: Jaisalmer: Amarsagar (No. 10121a !).

Distrib.: All temperate and many tropical countries.

Fl. and fr. in November.

Sonchus oleraceus, L. Sp. Pl. (1753) 794.
Loc.: Jaisalmer: Near Loharki, on sand dune (No. 10122 !).
Distrib.: All temperate and many tropical countries.
Fl. in November.

Launœa Cass.

Launœa nudicaulis, Hook. f. Fl. Brit Ind. III (1881) 416.
Vern. N.: Akria, jangli gobi, ban gobi (Macadam).
Loc.: Jodhpur: Mandor (No. 10125 !), Barmer, rocks (Nos. 10123 !, 10126 !).
Jaisalmer: Bada Bag (No. 10124 !).
Distrib.: From India westwards to the Atlantic.
Fl. and fr. in October and November.

Launœa chondrilloides, Hook. f. Fl. Brit. Ind. III (1881) 415.
Vern. N.: Dhud phad.
Loc.: Jodhpur: Kailana (Nos. 10133 !, 10140 !, 10127 !), Mandor (No. 10138 !), Osian (No. 10137 !), Balarwa (10142 !), Bhikamkor (No. 10143 !), Barmer (Nos. 10128 !, 10129 !), near Badka (No. 10136 !), Kotda near Seu (No. 10139 !), Jaisalmer: Loharki (No. 16134 !), Jaisalmer, rocky plateau (No. 10135 !). Jaisalmer, sand (No. 10130 !), near Devikot (Nos. 10141 !, 10132 !, 10131 !).
Distrib.: India, Afghanistan, Persia, Arabia, Egypt.
Fl. and fr. in October and November.
Uses: The water in which the plant has been boiled is taken against constipation.

Tagetes L.

Tagetes erecta, L. Sp. Pl. (1753) 887.
Loc.: Jodhpur: Balarwa (No. 10146 !). Jaisalmer: Amarsagar (No. 10147 !).
Distrib: Probably Mexico.
Fl. in October and November.

Flaveria Juss.

Flaveria contrayerba, Pers. Syn. II, 489.
Loc.: Jodhpur: Balarwa No. 10148 !), Osian (No. 10149 !), near Badka, sand (No. 10150 !).
Distrib.: Peru, naturalized in India.
Fl. in October and November.

OLEACEÆ.

Jasminum L.

Jasminum grandiflorum, L. Sp. Pl. (1762) 9.
Vern. N.: Chameli.
Loc.: Jaisalmer: Amarsagar (No. 9097 !), Bada Bag (No. 9098 !). Introduced.
Loc.: Distrib.: Sub-tropical N. W. Himalaya.
Fl. in November.

SALVADORACEÆ.

Salvadora Garcin.

Salvadora persica, L. Sp. Pl. (1753) 122.
Vern. N.: Jal, fr. called pilu (Macadam).
Loc.: Balarwa (No. 9107 !), frequent in the salt districts of Pach Padra, and not uncommon about villages where it is probably planted (Macadam).
Distrib.: India, Ceylon, W. Asia, Egypt, Abyssinia.

A.—A rocky plain with little soil at Amarsagar near Jaisalmer. In the background *Euphorbia nerifolia*.

B.—A family of *Aristida hirtigluma* on volcanic ground. West of Loharki (Jaisalmer State).

Uses : The fruit and the leaves are eaten. They have a pungent taste, resembling that of mustard and cress.

Salvadora oleoides, Dcne. in Jacq. Voy. Bot. (1844) 140, t. 144.

Vern. N. : Jal (Macadam).

Loc. : Jodhpur : Mandor (No. 9101 !), Balsamand (No. 9106 !), Phalodi (No. 9100 !). Jaisalmer : Near Bap (No. 9099 !), Amarsagar (No. 9104 !), near Devikot (No. 9105 !), Vinjorai, dunes (Nos. 9103 !, 9102 !), not very abundant about Jodhpur, much more common in the neighbourhood of Balotra.

Distrib. : India, Arabia.

Uses : The fr. is eaten.

NOTE : We have a specimen of *S. oleoides* from Barmer with partly opposite, partly ternate leaves.

APOCYNACEÆ.

Wrightia R. Br.

Wrightia tinctoria, R. Br. in Mem. Wern. Soc. I (1811) 74.

Vern. N. : Kerna.

Loc. : Jodhpur (Macadam).

Distrib. : India, Ceylon, Timor.

Fr. at the beginning of the cold weather.

Uses : The wood is used for turning, making lacquered toys, etc.; the leaves produce a blue dye. The fruit is used medicinally (Macadam).

The following plants were found growing in the garden of Amarsagar (Jaisalmer) :—*Plumieria acutifolia* Poir., *Lochnera rosea* Reichb.

ASCLEPIADACEÆ.

Periploca L.

Periploca aphylla, Dcne. in Jacq. Voy. Bot. (1844) 109, t. 116.

Loc. : Western Rajputana (King).

Distrib.: Punjab, Rajputana, Sind, Afghanistan, Baluchistan, Persia, Arabia, Egypt.

Glossonema Dcne.

Glossonema varians Benth. in Benth. and Hook. f. Gen. Pl. II. (1876) 748.

Loc.: Jodhpur : Balarwa (No. 6559 !), Kotda near Seu (No. 6566!). Jaisalmer : Jaisalmer (No. 6555 !), near Devikot (No. 6556 !).

Distrib.: Sind, Rajputana, Baluchistan, Persia.

Calotropis R. Br.

Calotropis procera, R. Br. in Ait. Hort. Kew. ed. 2, II (1811), 78.

Vern. N : Ak, Akra, Akda.

Loc.: Jodhpur : Jodhpur (No. 6568 !), Osian (No. 6560!), near Badka, sand (No. 6561 !), Barmer (No. 6562 !). Jaisalmer : Sodakoer. riverbed (No. 6564 !), Jaisalmer (No. 6565 !), Shihad (No. 6558 !) Vinjorai (No. 6563 !), gregarious and very common in sandy soil.

Distrib. : India, Ava, Persia, Trop. Africa.

Flowers after the rains and throughout the cold season (Macadam).

Uses: The milky juice is used as a cure for coughs. The silky hair of the seeds to stuff pillows and quilts (Macadam).

Oxystelma R. Br.

Oxystelma esculentum, R. Br. in Mem. Wern. Soc. I. (1811) 40.

Loc.: Jodhpur : Balsamand (No. 6554 !). Jaisalmer : North of Jaisalmer (No. 6553 !), Amarsagar (No. 6567 !).

Distrib.: Indo-Malaya.

Pentatropis R. Br.

Pentatropis cynanchoides, R. Br. in Salt Voy. Abbys. (1814) Append. 64.
Loc.: Jodhpur : Mandor (No. 6583 !), Balsamand (6577 !), Kailana (No. 6579 !), Kotda near Seu (No. 6576 !), Barmer, rocks (No. 6578 !). Jaisalmer : North of Jaisalmer (No. 6575 !), Jaisalmer (No. 6581 !), Devikot (No. 6580 !).
Distrib.: India, Afghanistan, Baluchistan, Arabia, Trop. Africa.

Dœmia R. Br.

Dœonia extensa, R. Br. in Mem. Wern. Soc. I (1811) 50.
Vern. N.: Gaderiaka vel.
Loc.: Jodhpur: Jodhpur Fort (No. 6550 !), Kotda near Seu (Nos. 6552 !, 6551 !).
Distrib.: Ceylon, India, Afghanistan.
Fl. in October, fruits in November.

Sarcostemma R. Br.

Sarcostemma brevistigma, Wight Contr. (1834) 59.
Vern N.: Kursanni, Tanta (Macadam).
Loc.: Jodhpur: Barmer, in *Euphorbia* bushes and alone (No. 5672 !), Balarwa (No. 6573 !), growing in bushes of *Euphorbia nivulia* between Balsamand and Sur Sagar and elsewhere about Jodhpur (Macadam). Jaisalmer: North of Jaisalmer (No. 6584 !)
Distrib.: India.
Fl. from October to December.
Uses: The seeds are eaten. The root called satar is ground and applied to snake bites, and an infusion of it is taken by persons bitten by mad dogs (Macadam).

Leptadenia R. Br.

Leptadenia spartium, Wight Contrib. (1834) 48.
Vern. N.: Khimp (Macadam).
Loc.: Jodhpur : Phalodi (No. 6585 !), Mandor (No. 6586 !), Osian (No. 6570 !), Kailana (No. 6587 !). Jaisalmer : Jaisalmer, rocky plateau (No. 6569 !), Loharki) No. 6588 !), near Loharki (No. 6589 !), Jaisalmor (No. 6590 !), Vinjorai, dunes (No. 6591!), Sodakoer (No. 6592 !), very common in sandy places, often associated with *Ærua tomentosa*, *Zizyphus*, *Capparis aphylla* (Macadam).
Distrib.: India, Baluchistan, Arabia, Egypt.
Fl. in. October and November.
Uses: Ropes for charpoys &c., are made from the fibre, but they are not strong enough for well ropes (Macadam).

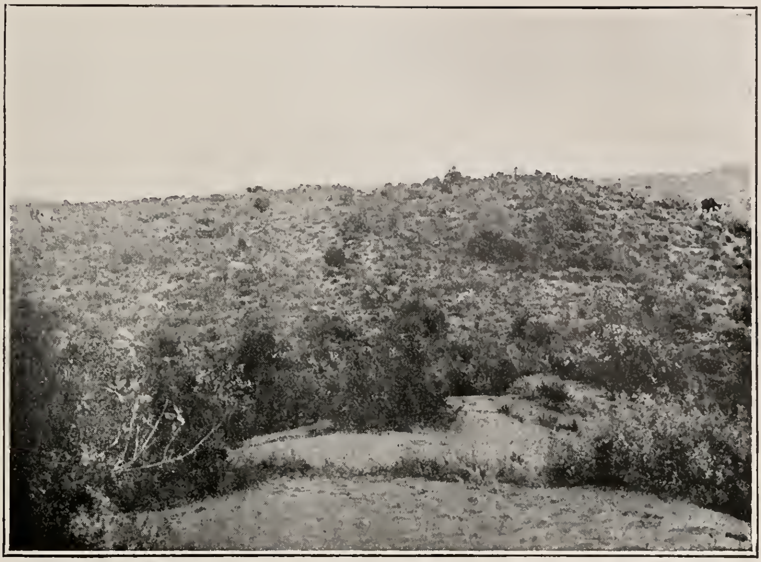
Cryptostegia R. Br.

Cryptostegia grandiflora, R. Br. in Bot. Reg. (1819), t. 435.
Loc.: Jodhpur (No. 6571), not indigenous.
Distrib.: Trop. Africa, introduced and spread throughout the dry Deccan districts and Guzerat.
Fl. and fr. in October.

GENTIANACEÆ.

Enicostemma Bl.

Enicostemma littorale, Bl. Bijdr. (1826) 848.
Loc.: Jodhpur: Kailana (No. 10360 !), Balarwa (No. 10361 !), near Badka, damp ground (No. 10365 !). Jaisalmer : Jaisalmer, wet ground (No. 10362 !), Vinjorai, dunes (Nos. 10363 !, 10364 !).



A.—Dune vegetation at Osian (Jodhpur State)

B.—Another view from the above dune area.

Distrib.: Tropics of the Old World, W. Indies.
Fl. and fr. in October and November.
Uses: The plant is crushed and applied locally against snake bite. When crushed and mixed with water it is taken internally against exhaustion.

Hoppea Willd.

Hoppea dichotoma, Willd. in Ges. Naturf. Fr. N. S. III (1801) 434.
Vern. N.: Ramjetta (Macadam).
Loc.: Jodhpur: In cultivated places, near water, about Jodhpur, not very common (Macadam).
Distrib.: India.
Uses: Used in piles and snake bite (Macadam).

Limnanthemum Gmel.

Limnanthemum parvifolium, Griseb. in DC. Prodr. IX (1845) 141.
Loc.: Near Badka (No. 5775 !).
Distrib.: India, Ceylon.

BORAGINACEÆ.

Cordia L.

Cordia rothii, Roem. & Schult. Syst. IV (1819) 798.
Vern. N.: Gondi (Macadam).
Loc.: Jodhpur: Jodhpur Fort (No. 10158 !), Kailana (No. 10159 !), Phalodi (No. 10160 !). Jaisalmer: Bap (No. 10161 !), Jaisalmer (No. 10162 !).
Distrib.: Abyssinia, Arabia, India, Ceylon.
Uses: The berry is eaten. The bark, mixed with catechu, is chewed by the poor to redden the lips, as a substitute for the more costly pan (Macadam).

Ehretia L.

Ehretia aspera, Roxb. Cor. Pl. I (1795) 41, t 55.
Loc.: Jodhpur: Kailana (Nos. 10164 !, 10165 !), Barmer (No. 10167 !). Jaisalmer: N. of Jaisalmer (No. 10166 !).
Distrib.: Abyssinia, Baluchistan, India.

Heliotropium L.

Heliotropium zeylanicum, Lam. Encycl. Meth. III (1789) 94.
Vern. N.: Khali bui (Macadam).
Loc.: Jodhpur: Jodhpur (Nos. 10195 !, 10194 !), Osian (No. 10196 !), Bhikamkor (No. 10197 !), near Badka, gravel (No. 10198 !). Jaisalmer: Loharki (No. 10199 !), Shihad (No. 10200 !), Amarsagar (Nos. 10201 !, 10202 !).
Distrib.: India, Trop. Africa.
Fl. and fr. in October and November.
Uses: Eaten by camels.

Heliotropium supinum, L. Sp. Pl. (1753) 130.
Loc.: Jodhpur: Barmer, rocks (No. 10204 !). Jaisalmer: N. of Jaisalmer (No. 10207 !), Vinjorai, gravel near tank (Nos. 10205 !, 10206 !).
Distrib.: Mediterranean, S. Africa, India.
Fl. and fr. in November.

Heliotropium rariflorum, Stocks in Kew Journ. Bot. IV (1852) 174.
Vern. N.: Kharshni.
Loc.: Jodhpur: Osian (No. 10268 !), Bhikamkor (No. 10269 !), near Badka (No. 10270 !) near Badka on sand (No. 10271 !), Barmer (No. 10272 !). Jaisalmer: Jaisalmer (No. 10274 !), Jaisalmer, rocky

plateau (Nos. 10275 !, 10276 !). Amarsagar (Nos. 10277 !, 10278 !, 10279 !), Vinjorai on rocks (Nos. 10280 !, 10281 !).
Distrib. : India, Baluchistan, Nubia, Socotra.
Fl. and fr. in October and November.

Heliotropium eichwaldi, Steud. ex DC. Prodr. IX 1845) 535.
Vern. N. : Khali bui, Tinderu.
Loc. : Jodhpur : Kailana (No. 10209 !), Seu, near tank (No. 10210 !), Jaisalmer : Amarsagar (Nos. 10208 !, 10211 !).
Distrib. : W. and C. Asia, India, Australia.
Fl. and fr. in October and November.
Uses : The leaves rolled up and put into the ear are said to cure ear-ache (Macadam).

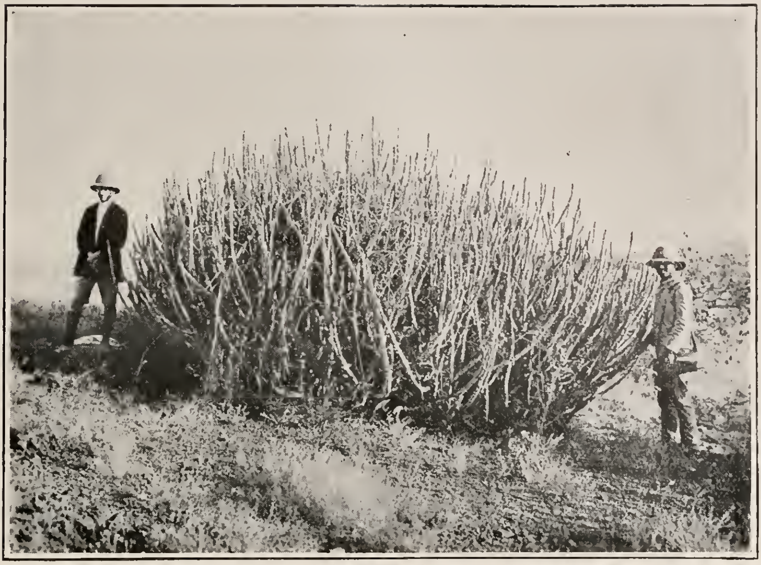
Heliotropium calcareum, Stocks in Kew Journ. Bot. IV (1852) 174.
Vern. N. : Jal bangra, Kali bui (Macadam).
Loc. : Jodhpur : A common weed in cultivated places (Macadam).
Distrib. : Rajputana, Sind, Baluchistan.

Heliotropium ovalifolium, Forsk. Fl. Aegypt. Arab. (1775) 38.
Loc. : Jodhpur : Jodhpur (No. 10212 !), Balsamand (No. 10213 !).
Distrib. : Trop. Africa, India, Australia.
Fl. and fr. in October.

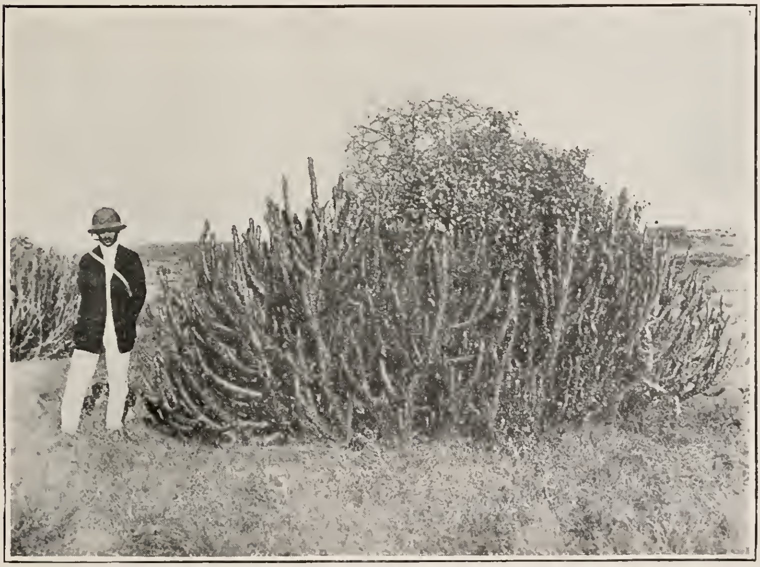
Heliotropium undulatum, Vahl. Symb. I, 13.
Loc. : Jodhpur : Jodhpur (No. 10214 !), Phalodi (No. 10215 !), Balarwa (No. 10216 !), Mandor (No. 10217 !), Kotda near Seu (No. 10218 !). Jaisalmer : Near Loharki (No. 10219 !), Loharki (No. 10220 !), Amarsagar (No. 10221 !), N. of Jaisalmer (No. 10222 !), Devikot (No. 10223 !), Vinjorai (No. 10224 !).
Distrib. : N. Africa, W. Asia, India.
Fl. and fr. in October and November.
NOTE : We have not found a sufficient reason to separate *H. undulatum* Vahl. from *H. tuberculosum* Boiss. (=*H. undulatum*, Vahl var. *tuberculosum* Boiss. (See Cooke Fl. Bomb. II, 212).

Heliotropium undulatum, Vahl. Symb. I, 13. *var. suberosa*, C. B. Clarke, in Hook. Fl. Brit. Ind. IV, 151.
Loc. : Jodhpur : Kotda near Seu (No. 10225 !). Jaisalmer : Near Bap (No. 10227 !), Bap (No. 10226 !), Loharki, gravel and rocks (No. 10228 !), Sodakoer (No. 10229 !).
Distrib. : N. Africa, W. Asia, India.
Fl. and fr. in November.
NOTE : The mature fruit has nutlets with a simple or bilobed corky outgrowth on the back. This character appears to be constant and we, therefore, retain Clarke's name, although the nutlets in our specimens are four and each of them contains one seed.

Heliotropium paniculatum, R. Br. Prodr. (1810) 494.
Loc. : Jodhpur : Jodhpur (Nos. 10235 !, 10234 !, 10232 !, 10233 !), Kailana, near a tank (Nos. 10236 !, 10237 !), Balarwa (No. 10231 !), Osian (No. 10238 !), Phalodi (Nos. 10239 !, 10240 !). Kotda near Seu (No. 10241 !), Barmer, sand (Nos. 10242 !, 10243 !). Jaisalmer : Shihad (No. 10244 !), Shihad gravel (No. 10245 !), near Loharki (No. 10246 !), Loharki (No. 10247 !), Sodakoer (No. 10249 !), Jaisalmer (Nos. 10250 !, 10251 !), Bada Bag (No. 10252 !), Vinjorai, rocks (No. 10253 !).
Specimens attacked by a kind of spike disease were found in the following localities :—
Jodhpur : Jodhpur (No. 10260 !), Kailana (No. 10259 !), Bhikamkor (No. 10257 !), Phalodi, sand dunes and gravelly soil (No. 10256 !), Barmer, sand (No. 10255 !). Jaisalmer : Loharki (No. 10261 !),



A.—Near Kailana Lake. A specimen of *Euphorbia neriifolia*, supporting *Sarcostemma brevistigma*.



B.—On the rocky plateau above Mandor near Jodhpur. A clump of *Euphorbia neriifolia*, *Capparis decidua*, and *Convolvulus glomeratus var. volubilis*. The low vegetation consisting chiefly of *Aristida*.

Sodakoer, riverbed (No. 10262!), Jaisalmer, rocky plateau (No. 10263!), near Devikot (No. 10265!), Vinjorai, sandy plain (Nos. 10266!, 10267!).

Distrib.: Indo-Malaya, Australia.

Fl. and fr. in October and November.

Heliotropium strigosum, Willd. Sp. Pl. I, 743.

Vern. N.: Choti santri (Macadam).

Loc.: Jodhpur: Common about gardens (Macadam). We have not seen this species.

Distrib.: W. Asia, Indo-Malaya, Australia.

Trichodesma R. Br.

Trichodesma indicum, B. Br. Prodr. (1810) 496.

Vern. N.: Sal konta.

Loc.: Jodhpur: Jodhpur (No. 10151!), Mandor (No. 10152!), Balarwa (No. 10153!), Barmer, rocks (No. 10154!). Jaisalmer: Amarsagar (Nos. 10155!, 10156!), Bada Bag (No. 10157!).

Distrib.: Mauritius, Persia, Baluchistan, Cabul, India, Ceylon.

Fl. and fr. in October and November.

Sericostoma Stocks.

Sericostoma pauciflorum, Stocks in Wight Ic. (1850) t. 1377.

Loc.: Jodhpur: Kailana (No. 10177!), Mandor (No. 10178!), Osian (No. 10179!), Balarwa (Nos. 10180!, 10181!), Bhikamkor (No. 10182!), Bhikamkor, dunes (No. 10183!), Phalodi (Nos. 10184!, 10185!), Kotda near Seu, rocks, (No. 10186!), Barmer, sand (Nos. 10187!, 10188!). Jaisalmer: Loharki (10190!), Amarsagar (No. 10191!), Vinjorai, dunes (Nos. 10192!, 10193!).

Distrib.: India.

Fl. and fr. in October and November.

Arnebia Forsk.

Arnebia hispidissima, DC. Prodr. X (1846) 94.

Vern. N.: Rambas, rambaiya (Macadam).

Loc.: Jodhpur: Kailana (Nos. 10168!, 10169!), Osian (No. 10170!), Balarwa (No. 10171!), Bhikamkor (No. 10172!), Badka (No. 10173!). Jaisalmer: Loharki (No. 10174!), Sodakoer (No. 10175!), Vinjorai, sand (10176!).

Distrib.: Egypt, Nubia, W. Asia, India.

Fl. and fr. in October and November.

CONVOLVULACEÆ.

Cuscuta L.

Cuscuta hyalina, Roth Nov. Pl. Sp. (1821) 100 (non Wight).

Vern N.: Amar bel.

Loc.: Jodhpur: Jodhpur Fort (No. 2990!), Balarwa (Nos. 3544!, 3547!), Phalodi (No. 2983!), Bhikamkor (No. 3548!), Seu (No. 3546!). Jaisalmer: Vinjorai, sandy plain (No. 6662!), Jaisalmer (No. 3570!), Devikot (No. 3545!, Loharki (No. 2989!), Amarsagar (No. 2982!).

Distrib.: India, Baluchistan, Abyssinia.

Fl. and fr. in October and November.

NOTE: *Cuscuta* has been found parasitic on the following plants: Various *Ficoideæ*, *Tribulus*, *Calotropis procera*, *Aerua*, *Amarantus polygamus*, *Boerhavia*, *Desmodium*, *Rhynchosia*.

Uses: Boiled in water the plant is taken against pain in the chest.

Cressa L.

Cressa cretica, L. Sp. Pl. (1753) 223.
Loc.: Jodhpur: Near Badka (No. 3521 !).
Distrib.: All warm countries.

Evolvulus L.

Evolvulus alsinoides, L. Sp. Pl. ed. 2 (1762) 392.
Loc.: Jodhpur: Kailana (Nos. 3525!, 3532 !), Balsamand (No. 3524 !), Bhikamkor (No. 3533 !), Mandor (No. 3534 !), Barmer, rocks (No. 3523 !).
Distrib.: Tropical and sub-tropical countries.
Fl. in October and November.

Breweria R. Br.

Breweria latifolia, Benth. ex C. B. Clarke in Hook. f. Fl. Brit.. Ind. IV (1883) 224.
Loc.: Jodhpur: Phalodi (No. 6563!), Kotda (No. 3531 !), Kotda, sand and gravel (No. 3530 !), Balsamand (No. 3505 !). Jaisalmer: Amarsagar (Nos. 3528 ! 3529 !), Jaisalmer, sand (No. 3517 !), Vinjorai, rocks (No. 6664 !), Jaisalmer, rocky plateau (No. 6665 !).
Distrib.: India, Trop. Africa.
Fl. and fr. in October and November.

CONOVOLVULUS L.

Convolvulus rottlerianus, Choisy Convolv. Orient in Mem. Soc. Phys. Genev. VI (1834) 477.
Loc.: Jodhpur: Jodhpur (No. 6677 !), near Badka (No. 6666 !), Vinjorai, sandy plain (No. 3506 !). Jaisalmer: Between Phalodi and Bap (No. 3516 !), near Bap (Nos. 6667 !, 6668 !).
Distrib.: India, Afghanistan, Baluchistan.
Fl. and fr. in October and November.

Convolvulus microphyllus, Sieb. ex Spreng. Syst. 1 (1825) 611.
Loc.: Jodhpur: Phalodi (No. 3512 !), Osian (Nos. 3501 !, 2995 !, 6678 !), Kailana (Nos. 2994 !, 6679 !), Balarwa (Nos. 2996 !, 6680 !), Mandor (Nos. 3503 !, 3000 !), Barmer (Nos. 3501 !, 3513 !). Jaisalmer: Sodakocr, riverbed (Nos. 3510 !, 3504 !), Loharki (No. 3511 !), Vinjorai (Nos. 2999 !, 2997 !), Jaisalmer (No. 2998 !), Devikot (No. 2981 !).
Distrib.: From India to Egypt and Nubia.
Fl. and fr. in October and November.

Convolvulus glomeratus, Choisy ex Dc. Prodr. IX (1845) 401.
Vern. N.: Rota bhel.
Loc.: Jodhpur: S. E. of Luni (No. 3535 !), Kailana (No. 2551 !), Seu (No. 6683 !), Barmer (No. 6682 !). Jaisalmer: Jaisalmer, rocky plateau (No. 3537 !).
Distrib.: India, Afghanistan, Baluchistan, W. Trop. Africa.
Fl. and fr. in October and November.

Convolvulus conglomeratus var. *volubilis*, C. B. Glarke in Hook. Fl. Brit. Ind IV, 219.
Vern. N.: Rota bhel, Ratanjot.
Loc.: Jodhpur: Barmer (No. 3553 !), Barmer, rocks No. 3536 !), near Badka (No. 3519 !), Phalodi (No. 3552 !), Mandor (No. 6690 !), Kailana (No. 3538 !). Jaisalmer: Amarsagar (No. 3520 !), Jaisalmer (No. 6684 !), N. of Jaisalmer (No. 3539 !), near Bap (No. 6691 !), Vinjorai, rocks (No. 3550 !).
Fl. and fr. in October and November; according to Macadam it flowers also in February.

A.—A sandy plain at Sodakoer village (Jaisalmer State). An association of *Aerua tomentosa* and *Aerua pseudo-tomentosa*, with families of *Capparis decidua*.

B.—*Cistanche tubulosa*, parasitic on the roots of *Capparis decidua* in the above locality.

Uses: The whole plant soaked in cold water is used as a cooling drink (Macadam).

Convolvulus pluricaulis, Chois. Convolv. Orient. 95, var. *macra* C. B. Clarke in Hook. Fl. Brit. Ind. IV, 218.

Vern. N.: Santari, Sanowri, Santer (Macadam).

Loc.: Jaisalmer. Common in the plains (Macadam).

Distrib.: Punjab.

Convolvulus arvensis, L. Sp. Pl. (1753) 153.

Loc.: Jodhpur.

Distrib.: Cosmopolitan.

Fl. in October.

Convolvulus rhyniospermus, Hochst. ex Choisy in DC. Prodr. IX (1845) 405

Loc.: Jaisalmer: Vinjorai (No. 6681!), Jaisalmer, rocky plateau (No. 3508!).

Distrib.: Rajputana, Sind, Kordofan.

Fl. and fr. in November.

Convolvulus densiflorus spec. nov.—(Prope *C. rhyniospermum* Hochst.).

Herba perennis, prostrata vel ascendens; caulis suque ad 75 cm. longus simplex vel ramis multis lateralibus brevibus, teres, aliquantulum hirsutus, fortis, fistulosus. Folia conferta a basi caulis et ramorum ad apicem, ita quidem ut axis vix conspici possit, integerrima, viridia, elliptica vel oblanceolata, basi attenuata, 35 mm. longa, 11 mm. lata, apice subacuta vel subobtusa, juniora parce hirsuta pilis longis, matura glabrata, nervis inferne prominentibus; petiolus 3 mm. longus.

Flores dense capitati pedunculis axillaribus. Pedunculi 10 mm. attingentes, rarius 25 mm. villosi, fortiusculi. Bracteæ confertæ-foliis similes sed minores, ovatæ vel lanceolatæ vel ellipticæ, genera, tim apice acutæ, densissime hirsutæ pilis longis sericeis in parte inferiore, gradatim glabrescentes apicem versus. Sepala exteriora anguste lanceolata, acuta 8 mm. attingentia; densissime villosa in 2/3 inferioribus, parte apicali glabrata; sepala interiora subulata, 7 mm. attingentia, passim densissime villosa vel apice glabrata. Corolla pallida-rubra, calyce subbrevior; lobi brevissimi, apice paululum penicillati. Filamenta glabra inæqualia. Stylus glaber; stigma glabrum lineare, stylo fere æquilongum.

Capsula globosa, bilocularis, 4-valvis, scariosa, glabra. Semina 4, glabra tuberculata.

Loc.: Jodhpur: Balarwa (No. 7312!), Jaisalmer: Amarsagar (No. 3515!), N. of Jaisalmer (No. 3514!).

Fl. and fr. in October and November.

Convolvulus gracilis, spec. nov.

Herba perennis, erecta, ramis multis erectis filiformibus, 50 cm. alta, adpresse argento-canescens in omnibus partibus calyce et corolla exceptis. Folia anguste-linearia, 21 mm. longa, 3/4 mm. lata.

Flores multi in cymis largis laxis terminalibus. Pedunculi et pedicelli filamentosi; pedicelli, 2-10 mm. longi. Bracteæ et bracteolæ subulatæ. Bracteæ 5 mm. attingentes, bracteolæ circa. 2 mm. longæ. Sepala glabra, 3½ mm. longa, paululum incrassata in fructu, interiora minora, omnia ovata, exteriora latiora, apice acuta vel breviter acuminata, venis multis longitudinalibus parallelis. Corolla rubra, calyce duplo longior; lobi hirsuti in parte dorsali, breves. Ovarium 2-loculare, 4-ovulatum. Filamenta stylusjue glabra; stigma lineare stylo fere æquilongum.

Capsula exserta, glabra, coriacea, straminea. Semina dense tomentosa pubescentia.

Loc.: Jodhpur: Barmer, on rocks (Nos. 7313 !, 7314 !).
Fl. and fr. in November.

Jacquemontia Choisy.

Jacquemontia paniculata, Hallier f. in Engl. Jahrb. XVI (1893) 541 and XVIII (1894) 95.
Loc.: Jodhpur: Jodhpur (No. 2980 !).
Distrib.: Trop. Africa, Indo-Malaya, Australia.
Fl. in October.

Merremia Dennst.

Merremia ægyptia, L. Sp. Pl. (1753) 162.
Vern. N.: Rota bel.
Loc.: Jodhpur: Kailana (No. 3556 !), Barmer (No. 3509 !), Kotda near Seu (No. 3543 !). Jaisalmer: Bada Bag (No. 6676 !).
Distrib.: Tropics generally, often cultivated.
Fl. in October and November.

Ipomœa L.

Ipomœa eriocarpa, R. Br. Prodr. (1810) 484.
Loc.: Jodhpur: Jodhpur Fort (Nos. 3527 !, 3526 !), Jodhpur (No. 6674 !), Balarwa (No. 6692 !).
Distrib.: Tropics of the Old Word, Afghanistan.
Fl. and fr. in October.

Ipomœa sindica, Stapf. in Kew Bull. (1894) 346.
Vern. N.: Rota belri.
Loc.: Jodhpur: Balarwa (Nos. 6685 !, 3569 !), near Badka (No. 3561 !), Osian (No. 3564 !), Barmer (Nos. 6686 !, 3568 !, 3557 !, 3566 !), Kailana (Nos. 3565 !, 6687 !, 3567 !). Jaisalmer: Between Phalodi and Bap (No. 3562 !), Sodakoer (No. 3563 !).
Distrib.: N.-W. India, Sind, Rajputana.
Fl. and fr. in October and November.

Ipomœa aquatica, Forsk. Fl. Ægypt.-Arab. (1775) 44.
Loc.: Jaisalmer: Bada Bag (No. 2987 !).
Distrib.: Trop. Africa, Asia, Australia.
Fl. in November.

Ipomœa obscura, Ker-Gawl. in Bot. Reg. (1817) t. 239.
Loc.: Jodhpur (No. 2988 !).
Distrib.: Africa, Indo-Malaya.
Fl. in October.

Ipomœa palmata, Forsk. Fl. Ægypt.-Arab. (1775) 43, var. *semine glabro var. nov.*—Semina omnino glabra.
Loc.: Vinjorai (No. 6675 !).
Fr. in November.

Ipomœa pestigridis, L. Sp. Pl. (1753) 162.
Loc.: Jodhpur: Osian (No. 3554 !, 3558 !), Phalodi (No. 3542 !), Balarwa (No. 3560 !), Jodhpur (No. 6688 !). Jaisalmer: Bap (No. 3541 !), Amarsagar (No. 3540 !), between Phalodi and Bap (No. 3555 !), Jaisalmer (No. 3559 !).
Distrib.: Trop. Africa, Indo-Malaya to Polynesia.
Fl. and fr. in October and November.

Ipomœa batatas, Poir Encycl. Meth. VI (1804) 14.
Loc.: Cultivated in Jodhpur State (Erskine).
Distrib.: Tropical America.

A.—An open forest of *Zizyphus rotundifolia* between Loharki and Sodakoer (Jaisalmer State). In the foreground a bare gravel area and an isolated specimen of *Prosopis spicigera.*

B.—Rocky river bank, two miles East of Sodakoer, with *Schweinfurthia hærocarpa* and *Anticharis linearis.*

Rivea Choisy.

Rivea hypocrateriformis, Choisy Convolv. Orient. in Mem. Soc. Phys. Genev. VI (1834) 408.

Loc.: Jodhpur: Mandor (No. 2992 !). Jaisalmer: Amarsagar (Nos. 3507 !, 2986 !), Bada Bag (No. 2991 !), between Phalodi and Bap (No. 2985 !).

Distrib.: India.

Fl. in October; fr. in October and November.

SOLANACEÆ.

Solanum L.

Solanum nigrum, L. Sp. Pl. (1753) 106.

Vern. N.: Chirpoti, Mokko.

Loc.: Jodhpur: Phalodi (No. 6514 !), Jodhpur Fort (6515 !), Balsamand (No. 6513 !). Jaisalmer: Amarsagar (No. 6516 !), Bap (No. 6517 !).

Distrib.: Cosmopolitan in the temperate and tropical regions of the world.

Fl. and fr. in October and November.

Uses: A decoction of the plant is used in fever. The crushed leaves are used as an application for boils (Macadam).

Solanum xanthocarpum, Schrad. and Wendl. Sert. I (1795) 8, t. 2.

Vern. N.: Boringni, Adkuntali (Macadam).

Loc.: Jodhpur: Jodhpur (No. 6521 !), Mandor (No. 6520 !), Balsamand (No. 6518 !), Balarwa (No. 6548 !), Barmer (No. 6519 !), common in sandy places near villages (Macadam).

Distrib.: Indo-Malaya, Australia, Polynesia.

Fl. and fr. in October and November.

Uses: The berries are used to cure cough and tooth-ache, for the latter they are burnt and the smoke is taken into the mouth (Macadam).

Solanum indicum, L. Sp. Pl. (1753) 187.

Loc.: Jaisalmer: Loharki (No. 6549 !).

Distrib.: Indo-Malaya to the Philippines.

Solanum incanum, L. Sp. Pl. (1753) 188.

Loc.: Jodhpur: Barmer (No. 6506 !), Bhikamkor (No. 6504 !), Osian (No. 6503 !), Jaisalmer: Devikot (No. 6507 !).

Distrib.: India, S.-W. Asia, Arabia, Egypt.

Fl. and fr. in October and November.

Solanum albicaule, Kotschy ex Dunal in DC. Prodr. XIII, Pt. II (1852) 204.

Vern. N.: Narkata.

Loc.: Jodhpur: Near Badka (No. 6510 !), Kotda, near Seu, growing in Euphorbia bushes (No. 6512 !), Barmer, on rocks (No. 6508 !), Mandor (No. 6511 !), Bhikamkor (No. 6501 !). Jaisalmer: Vinjorai (No. 6509 !).

Distrib.: Sind, Arabia, Trop. Africa.

Fl. and fr. in October and November.

Uses: The water in which the crushed plant has been boiled is taken against ulcers.

Solanum melongena, L. Sp. Pl. (1753) 186.

Vern. N.: Brinjal.

Loc.: Jaisalmer: Amarsagar (No. 6505 !).

Distrib.: Native country uncertain.

Solanum tuberosum, L. Sp. Pl. (1753) 185.

Cultivated in Jodhpur State.

Physalis L.

Physalis minima, L. Sp. Pl. (1753) 183.
Loc.: Jodhpur: Bhikamkor (No. 6523!), Jodhpur (No. 6526!), Barmer on sand (No. 6524 !).
Distrib.: Trop. Africa, India, Ceylon, Australia.
Fr. in October and November.

Physalis peruviana, L. Sp. Pl. (1763) 1670.
Loc.: Jaisalmer: Between Phalodi and Bap (No. 6525!),

Withania Pauq.

Withania somnifera, Dunal in DC. Prodr. XIII, Pt. I (1852)453.
Vern. N.: Argan, Chirpotan (Macadam).
Loc.: Jodhpur: Jodhpur (No. 6533 !), Mandor (Nos. 6522!, 6534)!.
Distrib.: Mediterranean region, Cape of Good Hope, India, Ceylon.
Fl. in October.
Uses: Used as a cure for lumbago and rheumatism.

Lycium L.

Lycium barbarum, L. Sp. Pl. (1753)192.
Vern. N.: Morali.
Loc.: Jodhpur: Kailana (No. 6547!), Balarwa (No. 6539 !), Osian (No. 6537 !), near Badka (No. 6536 !), Barmer (No. 6544 !). Jaisalmer: Amarsagar (Nos. 6546!, 6541 !, 6545 !, 6543 !), Devikot (No. 6542 !), Vinjorai, dunes (No. 6540 !), near Bap (No. 6538 !), common in dry and rocky places (Macadam).
Distrib.: India, Baluchistan, Afghanistan, Persia.
Fl. in October.
Uses: The leaves, pounded and mixed with ghee, are applied to abscesses. The bark of the wood is pounded and the powder blown into the nostrils of horses against bronchitis. Used in local salt-industry.

The process at Pachbhadra is as follows:—"Oblong pits of various sizes are dug, a supply of brine percolates through the pit bed, and when that has become sufficiently concentrated, so as to show signs of crystallisation around the pit edge, branches of a thorny shrub, called morali, a species of mimosa (No, of Lycium !) are sunk in it. On these branches salt crystals form and continue to grow for two, or sometimes three years. At the end of that period the salt crop is extracted, usually in this way: men enter the pit, and with an iron chisel, wedge-shaped, and having a handle five feet long, they cut through the thorny branches, and break up the salt which is caked on the bottom. By shaking the branches the crystals are detached."—Adams 5.

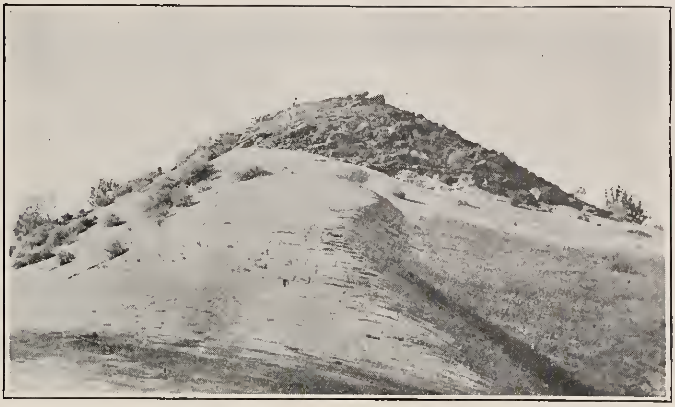
Datura L.

Datura fastuosa, L. Syst. Nat. ed. 10 (1759)932.
Vern. N.: Datura, dhola (Macadam).
Loc.: Jodhpur: Balarwa (No. 6531). Jaisalmer: Amarsagar (No. 6528 !).

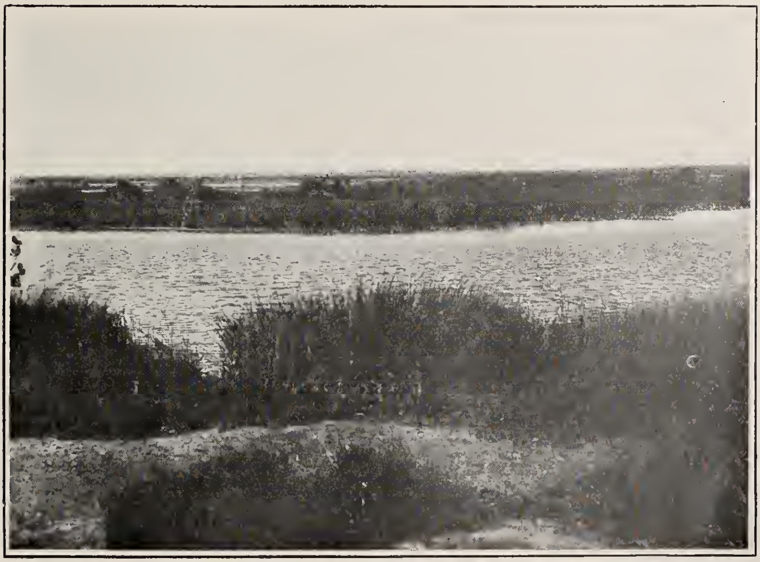
Datura fastuosa, var. *alba*, C. B. Clarke in Hook. f. Fl. Brit. Ind. IV (1883) 243.
Loc.: Jaisalmer: Bap (No. 6529 !). Jodhpur: Barmer (No. 6530 !). About gardens and cultivated places, more common than the type (Macadam).

Nicotiana L.

Nicotiana tabacum, L. Sp. Pl. (1753) 180.
Loc.: Jodhpur: "A coarse tobacco is grown round some of the villages and is consumed locally (Erskine)."



A.—Sand-dune north of Jaisalmer. On the right a family of *Cyperus arenarius*, to the left *Aerua sp.*, on the hill in the background *Fagonia cretica*.



B.—Pond and marshy ground between Phalodi and Bap with various *Cyperaceæ*.

Lycopersicum Mill.

Lycopersicum esculentum, Mill. Gard. Dict. ed. 8 (1768) n. 2.
Tomato.
Loc. : Jodhpur : Barmer (No. 6502!).

Capsicum L.

Capsicum annuum, L. Hort. Cliff. (1737)59, var. *acuminata,* Fingerh. Monogr. Gen. Caps. (1832) 13, t. 2.
Loc:. Jodhput : Balarwa (No. 6532!). Jaisalmer : Amarsagar (No. 6527 !)

SCROPHULARIACEÆ.

Anticharis Endl.

Anticharis glandulosa, Aschers. in Monatsb. Akad. Wiss. Berl. (1866) 880, var. *cœrulea, var. nov.*
Loc. : Jaisalmer : Bada Bag (No. 10282 !). Jaisalmer, rocky plateau (No. 10283 !), Jaisalmer on rocks (No. 10284 !), Vinjorai (No. 10285!).
Distrib. of type: Upper Egypt and Sind.
Fl. and fr. in November.

Anticharis linearis, Hochst. ex Aschers. in Monatsb. Akad. Wiss. Berl. (1866) 882.
Loc. : Jodhpur : Kailana (Nos. 10286 !, 10287 !, 10288 !), Mandor (No. 10289 !), Balarwa (No. 10290 !), Bhikamkor (No. 10291 !), Phalodi (No. 10292 !), near Badka (No. 10293 !), Barmer, rocks (Nos. 10294 !, 10295 !). Jaisalmer : Between Phalodi and Bap (No. 10296 !), near Bap (No. 10297 !), Shihad (No. 10298 !), Loharki (No. 10299 !) Sodakoer, riverbed (No. 10300 !), Amarsagar (No. 10301 !), Devikot (No. 10302 !), Vinjorai, dunes (No. 10303 !).
Distrib.: India through Arabia and Trop. Africa to the Cape Varde Islands.
Fl. and fr. in October and November.

Celsia L.

Celsia coromandeliana, Vahl. Symb. Bot. III (1794)79.
Loc. : Jodhpur : Balsamand (No. 10307 !), Jaisalmer : Bada Bag (No. 10308 !).
Distrib. : India, Ceylon, Afghanistan, Ava, China.
Fl. and fr. in November.

Schweinfurthia A Braun.

Schweinfurthia sphœrocarpa, A. Braun in Monatsb. Akad. Wiss. Berl. (1866) 875.
Loc. : Jaisalmer : Sodakoer, riverbed (Nos. 10304 !, 10305 !), N. of Jaisalmer (No. 10306 !).
Distrib. : Afghanistan, Baluchistan, Sind, Rajputana.
Fl and fr. in November.

Paplidium, Del.

Peplidium humifusum, Del. Descr. de L'Egypte (1812) 148, t. 4.
Loc.: Jodhpur : Seu (No. 10310 !), near Badka (No. 10311 !).
Distrib. : Egypt, Kurdistan, India, Ceylon, Australia.
Fl. and fr. in November.

Striga, Lour.

Striga orobancheoides, Benth. in Hook. Comp. Bot. Mag I (1835) 361 t. 19.
Vern. N. : Missi (Macadam).

Loc.: Jodhpur: Kailana (Nos. 10312 !, 10313 !, 10314 !), Mandor (Nos. 10315 !, 10316 !), Osian (No. 10317 !). Jaisalmer: Jaisalmer (No. 10318 !).

Distrib.: India, Ceylon, Arabia, Trop. and S. Africa.

Fl. and fr. in October and November.

Uses: Chewed to strengthen and colour the teeth (Macadam).

NOTE: We have observed several forms which may prove to be constant varieties:—

Forma I. Plant reddish, corolla rose.
Forma II. Plant green, corolla white.
Forma III. Plant reddish, corolla white.

Striga euphrasioides, Benth. in Comp. Bot. Mag. I (1835) 364.

Loc.: Jodhpur. Kailana (Nos. 10319 !, 10320 !), Balsamand (No. 10321 !), Mandor (Nos. 10322 !, 10323 !), Balarwa (No. 10324 !), Kotda, wet ground (No. 10325 !). Jaisalmer: N. of Jaisalmer (No. 10326 !), Devikot (Nos. 10327 !, 10328 !), Vinjorai (No. 10329 !).

Distrib.: India, Ceylon, Java.

Fl. and fr. in October and November.

Sopubia Buch.-Ham.

Sopubia delphinifolia, G. Don Gen. Syst. IV (1837) 560.

Loc.: Jodhpur: Balsamand (No. 10309 !).

Distrib.: India, Ceylon.

Fl. and fr. in October.

Lindenbergia Lehm.

Lindenbergia urticæfolia, Link & Otto Ic. Pl. Rar. Hort. Berol. (1828) t. 48.

Vern. N.: Pindru.

Loc.: Jodhpur: Balsamand (Nos. 10331 !, 10232 !), Kailana (No. 10333 !), Mandor (Nos. 10334!, 10335 !), Bhikamkor (No. 10336 !), Kotda (No. 10337 !), (Barmer No. 10338 !), Barmer on rocks (Nos. 10339 !), 10340 !, 10341), near cultivated places about Jodhpur, not very common (Macadam).

Distrib.: India, Afghanistan.

Fl. and fr. in October and November.

NOTE: Several of our specimens have acute calyx lobs, but subglabrous or pubescent ovaries and capsules. This shows that *L. abyssinica* Hochst. is not a good species and ought to be included under *L. urcicaefolia*, L. and O.

As regards the variations there seem to be two forms which may prove to be constant varieties. They are distinguished by the size of the corolla. Two specimens from Barmer have the corolla 4 and 11 mm. broad, respectively. Further material is required to clear up this point. (Similar variations were observed in Bombay specimen, see Journ. Bom. Nat. Hist. Soc. XXV, 424.)

OROBANCHACEÆ.

Cistanche Hoffmgg. & Link.

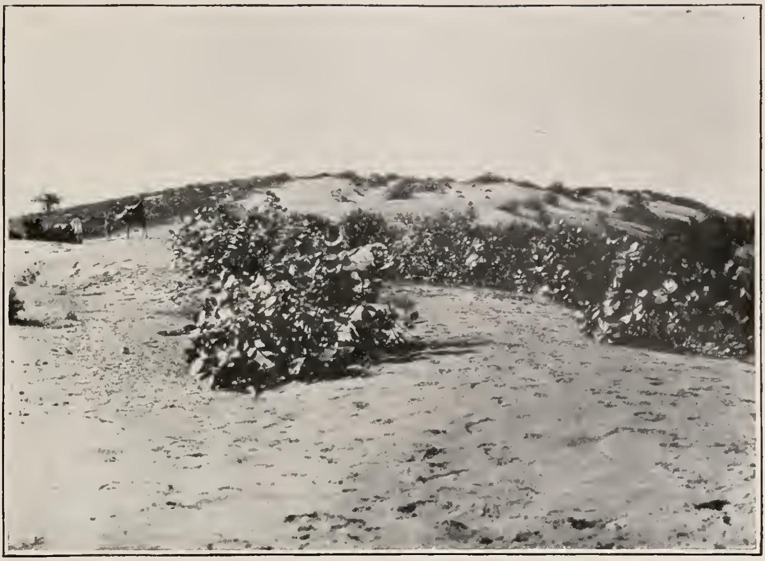
Cistanche tubulosa, Wight Ic. t. 1420 bis (1850).

Vern. N.: Beaphor, Lunki ka moola (=fox's radish) (Macadam), bhui phod.

Loc.: Jodhpur, not uncommon (Macadam). Jaisalmer: Near Bap (No. 10342 !), Shihad (No. 10343 !), Bada Bag (No. 10344 !), Devikot (No. 10345 !).

Distrib.: India, Central Asia to Arabia.

Fl. and fr. in October and November.



A.—Western slope of a sand-dune three miles south-west of Phalodi (Jodhpur State), with pure *Calotropis procera* association.

B.—Family of *Cyperus arenarius* covering the eastern slope of the above dune.

BIGNONICAEÆ.

Tecomella Seem.

Tecomella undulata, Seem. in Ann. and Mag. Nat. Hist. ser. 3, X (1862) 30,

Vern. N.: Rohera (Macadam).

Loc.: Frequent in the plains of Jodhpur (Macadam), W. Rajputana, found on some of the drier ridges of Jodhpur (King).

Distrib.: India, Baluchistan, Arabia.

Uses: The wood is used for Persian wheels, furniture, lacquered toys, etc. The seeds are used against abscesses.—In Godwar the term "Rohera ke phul" is applied to a pretentious good for nothing person (Macadam).

PEDALIACEÆ.

Sesamum L.

Sesamum indiqum, L. Sp. Pl. (1753) 634.

Vern. N.: Til.

Loc.: Jodhpur: Osian (No. 10347 !), Balarwa (No. 10349 !), Jaisalmer: Between Phalodi and Bap (No. 10354 !), Bap (No. 10350 !), near Lokarki (No. 10352 !), Shihad (No. 10353 !), N. of Jaisamer (No. 10351 !), Vinjorai (No. 10348). According to Adams, til is cultivated in the following parganas of Jodhpur :—Jalore, Jaswantpura, Mallani ,Jodhpur, Nagare, Merta, Parbatsar, Pali, Bali, Sojat, Jaitaran.

Distrib.: Trop. Africa ? cultivated throughout India.

Fl. and fr. in October and November.

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NOTES ON A COLLECTION OF SNAKES MADE IN THE NILGIRI HILLS AND THE ADJACENT WYNAAD.

By

Lieut.-Colonel F. Wall, i.m.s., c.m.g., c.m.z.s., f.l.s.

(With Diagrams and Maps.)

A period of sick leave lasting in all for four months in 1917, and spent in the Nilgiris gave me a great opportunity for studying the snakes of that locality, and the interesting plateau known locally as the Nilgiri-Wynaad.

My thanks are due to the many Planters around who were kind enough to assist me in collecting, and without whose aid I would have obtained but little. I am indebted to the following gentlemen: Mr. J. B. Vernede of Rookery Estate, Mr. L. Gerard Rogers of Adderley, Mr. C. Vernede of Hill Grove, Mr. C. Hercus of Glendale, Mr. A. K. Weld-Downing of Frith Hall, Mr. R. S. Hunter of Pilloor, Mr. G. Oakes of Kalhatti, Mr. W. B. de Courcy of Liddelsdale, Mr. J. H. Wapshare of Hope, Mr. F. W. F. Fletcher of Rockwood, Mr. J. E. Bisset of Mayfield, and Mr. V. W. G. Bisset of Wentworth. The first six of these gentlemen are on estates on the Eastern slopes of the Nilgiri Plateau. Mr. Oakes is in the middle of the plateau, and Mr. de Courcy on the north-west confines overlooking the Wynaad. The last four gentlemen have estates in the Nilgiri-Wynaad, a locality politically in the Nilgiris, but zoo-geographically part of the Wynaad. The terrain is a complicated mass of mountain ranges that calls for special remarks. The *Gazetteer of India* says of the Nilgiris:

"It consists of two well marked divisions: the high steep sided plateau formed by the junction of the Eastern and Western Ghats as they run southwards down the two opposite sides of the Indian Peninsula; and lower area adjoining, and geographically forming part of, the Malabar–Wynaad. The plateau, which is divided into the two *taluks* of Ootacamund and Coonoor, averages 6,500 feet above sea-level, and several of its peaks run up to over 8,000 feet. The lower area adjoining the Wynaad forms the third, or Gudalur, *taluk*, and is often called the South-East Wynaad. It is only 2,000 to 3,000 feet above the sea, is more level than the plateau, and is covered for the most part with thick forest. * * * Along the south-western edge of the plateau runs a line of bold hills called the Kundahs, several of the peaks in which are over 8,000 feet in height. * * * The Western Ghats join the Eastern Ghats in the high plateau of the Nilgiris."

"The Wynaad consists of a table land 60 miles by 30 miles, lying amid the Ghats at the average height of 3,000 feet above sea level.

Its most characteristic features are low ridges of hills, with sharp peaks (rising in some places to 6,000 feet) and extensive valleys. Towards the east, where it merges into the plateau of Mysore, the country becomes level. In the south-east the Ghats are low till they meet the Nilgiris near Naduvattam; on the west and south-west, where the *taluk* joins the low country of Malabar, there are several peaks of over 6,000 feet. The annual rainfall averages 130 inches, but is much heavier in the west than in the east."

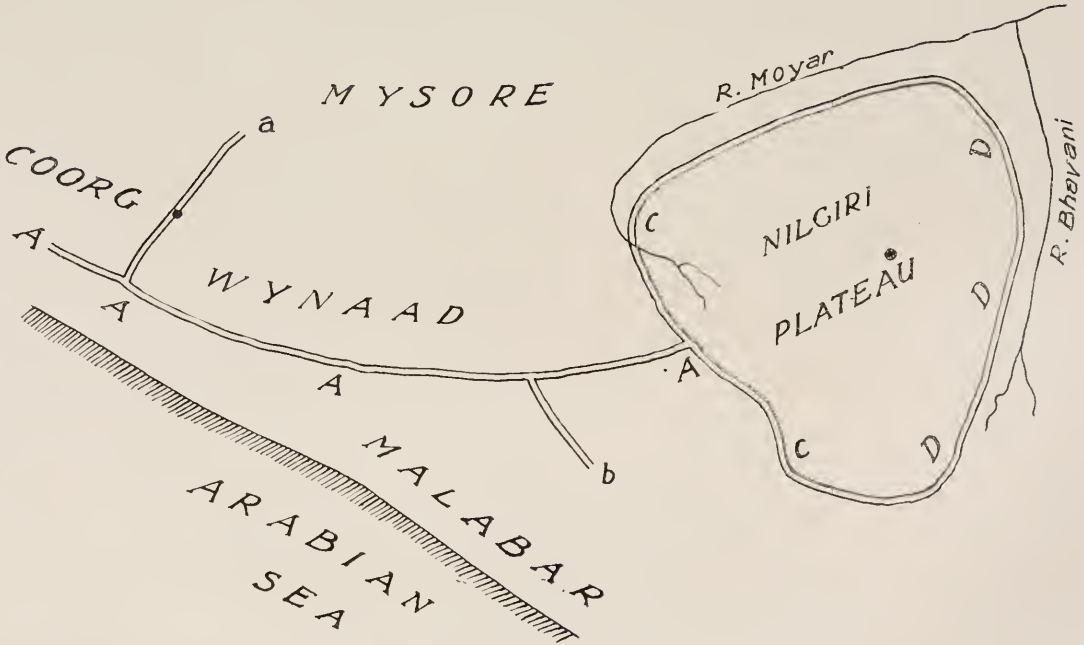
I am indebted to Mr. Fletcher of Rockwood for a far more detailed and lucid account of this terrain than can be gathered from the excerpts just quoted. I have erased from this a few sentences that were merely answers given to queries of mine, and which have no general interest as my preconceived ideas were hopelessly erroneous.

"The Wynaad is a narrow belt of jungle country lying between the Nilgiris and the Bramagiris. For the purposes of this argument its limits may be taken as coincident with the influence of the south-west monsoon above the Ghats. On the west the Sahyadris shut off this plateau from the Malabar plain: on the south (really south-east) the Kundahs separate it from the higher plateau of the Nilgiris. It is, then, easy to see why the species peculiar to the Wynaad cannot find egress to the Malabar plain or the Nilgiri plateau. North (really north-west) the Bramagiris form a dividing line between Wynaad and Coorg; and in this direction I should certainly expect the Wynaad snakes to continue up through Coorg, and the Mysore country adjacent to the Ghats, as far northwards as the physical conditions of altitude, rainfall, and climate conform to those of the Wynaad. These hills are neither very high nor very steep. The planting districts of Coorg and Mysore (and possibly a stretch of country farther north along the foot of Ghats) are so similar to Wynaad in every respect, that you would do well to make quite sure the Wynaad snakes are not found there. In these remarks you will see I take it for granted that all the species you found confined to the Nilgiri-Wynaad also occur in North and South Wynaad. I do this because the whole Wynaad belt has, practically, the same elevation, the same rainfall, and the same climate; and also because the boundaries between the three Wynaads are merely lines drawn on the map, and there is no natural barrier to confine the Wynaad species to the Nilgiri-Wynaad. As I have not studied the question, I cannot say definitely and from my own knowledge that the species peculiar to Nilgiri-Wynaad are common to all three divisions of the Wynaad, but I think this may safely be assumed. Eastwards, the Wynaad plateau merges insensibly into the table land of Mysore. There is nothing in the shape of a mountain range to prevent the extension of the Wynaad snakes into the

Mysore country. Here I think the climate is the barrier. When the moisture-laden clouds of the south-west monsoon strike the Ghats, they part at once with most of the contained water, and the rainfall during this period on, and in the immediate vicinity of the Ghats, is 250 inches at least. As the clouds pass inland, they discharge the rest of their contained moisture in a comparatively short distance, and so the south-west rains do not extend very far inland. Every mile you go east from the Ghats makes a difference of 10 inches or more. Nilgiri-Wynaad being further from the coast than South or North Wynaad, the rainfall is lighter. On our Ghats it is about 150 inches. I am not more than 5 miles from the Ghats in a direct line, yet my average drops to 90 inches. Estates lying east of Rockwood, and only about 2 miles away as the crow flies, get about 65 inches. And not much farther east still, the south-west monsoon peters out altogether. So, adjacent to Wynaad on the east there is a zone of the Mysore country where the annual rainfall is only about 40 inches, part received during the south-west monsoon, and part during the north-east monsoon. This makes a great difference in the physical aspect of the two zones, and an equally marked difference in the climate. The western face of the Ghats, exposed to the full force of the south-west monsoon, is mighty evergreen forest. On the Wynaad Plateau, this gives place to deciduous jungle, largely interspersed with bamboo. Directly the east limit of the monsoon is reached, the country changes completely, and becomes open and dry. In South-East Wynaad the climate can rightly be described as temperate—on Rockwood in the hot weather (March, April and May) the thermometer never climbs much over 80. But to cross the boundary into the dry Mysore country means a transition almost to the climate of the plains. It is this marked and sudden difference in rainfall, vegetation, and climate (which would mean a different habitat), that may I think account for the fact that the Wynaad species do not extend into Mysore. These views are crude, and very possibly in some respects they are erroneous. The western half of the Nilgiri Plateau is much higher than the eastern half: the Dodabetta ridge cuts the plateau in half, and forms a barrier between the east and west halves; and the rainfall is far heavier in the western half. The latter gets most of its rain during the south-west monsoon; the Coonoor or Eastern belt depends chiefly on the north-east monsoon."

The map illustrating the terrain referred to is a reduced reproduction of that given by Mr. F. W. F. Fletcher in his highly interesting and charmingly written book "Sport on the Nilgiris."

Altogether 1,699 snakes came in, of which 831 were collected in the Wynaad. This large total comprises 43 different species, one of which *Typhlops fletcheri* can be claimed as new to Science.


MYSORE
R. Moyar
R. Bhavani
COORG
a
A
A
WYNAAD
A
A
b
NILGIRI PLATEAU
C
C
D
D
D
MALABAR
ARABIAN SEA

Map II.—General scheme of Mountain Ranges.

NILGIRI SNAKES.

Several of these species are of course not truly montane. All of the species found in the plains of Southern India ascend to varying altitudes in the hills. In addition to the snakes I collected this year in the Nilgiris I had the good fortune to acquire a collection made by the late Mr. Grey from the same locality amounting to about 180 specimens. There was nothing rare among them, but they furnished a few interesting notes on food and breeding.

The following synopsis shows the numbers and localities from which they were collected :—

NILGIRI WYNAAD.

Serial Number.	Name of Species.	Rookery Estate 3,800 to 4,500 ft.	Adderley Estate 3,000 to 6,000 ft.	Hill Grove 3,000 to 5,700 ft.	Glendale 5,000 to 5,500 ft.	Coonoor 5,700 to 6,300 ft.	Frith Hall 5,400 to 6,300 ft.	Pilloor 3,000 to 5,800 ft.	Kalhatti 6,300 ft.	Liddelsdale 6,500 to 7,000 ft.	Hope 3,600 to 5,700 ft.	Rockwood 3,800 to 4,000 ft.	Mayfield 3,000 to 3,500 ft.	Wentworth 2,000 to 3,000 ft.	Total.
1	Typhlops fletcheri	..	1	..	..	..	..	2	..	..	..	3	..	..	6
2	„ beddomi	..	..	..	..	...	..	1	..	..	..	..	..	..	1
3	„ thurstoni	..	..	..	..	..	..	..	..	..	..	3	..	..	3
4	Rhinophis sanguineus ..	..	..	..	..	..	..	..	..	..	2	40	1	..	43
5	Silybura ocellata	..	..	..	..	..	..	..	..	4	99	2	..	..	105
6	„ brevis	..	..	..	..	..	..	..	..	..	22	38	2	..	62
7	Plectrurus perroteti	..	4	1	..	4	93	23	..	..	2	..	3	..	130
8	Melanophidium wynadense ..	..	..	..	..	..	..	..	..	1	19	8	..	..	28
9	Tropidonotus piscator	3	6	..	6	2	..	3	2	1	14	5	1	..	43
10	„ beddomi ..	3	27	2	..	..	..	19	..	12	30	14	..	..	157
11	„ stolatus ..	..	4	..	15	1	2	24	..	..	3	3	..	..	52
12	„ monticola plumbicolor ..	..	..	..	..	..	..	..	..	..	5	8	..	..	13
13	Macropisthodon	2	27	2	3	8	..	51	9	2	..	..	1	1	106
14	Rhabdops olivaceus	..	..	..	..	..	..	..	..	1	3	1	..	..	5
15	Xylophis perroteti	..	29	3	..	3	2	4	10	2	8	..	..	..	61
16	Lycodon auetcus	..	..	..	..	3	..	2	..	..	1	.	..	1	7
17	„ travancoricus ..	..	11	1	2	4	..	11	..	1	17	16	2	..	65
18	Zaocys mucosus	1	14	1	..	7	..	5	..	1	50	4	5	..	88
19	Coluber helena	3	24	3	3	..	..	50	..	3	11	7	2	1	107
20	Dendrelaphis tristis	..	..	..	..	..	..	6	..	..	..	..	..	..	6
21	Oligodon venustus	..	6	1	3	..	..	12	1	1	6	..	..	..	30
22	„ affinis	..	..	..	..	..	..	..	..	..	8	3	..	..	11
23	„ subgriseus	..	..	..	..	..	..	1	..	5	31	10	..	..	47
24	Ablabes calamaria	..	..	..	..	..	..	1	..	..	..	4	..	..	5
25	Dipsadomophus trigonatus	..	..	..	..	..	2	1	..	..	.	..	..	..	3
26	„ ceylonensis ..	..	..	..	..	..	..	1	..	6	33	..	..	..	40
27	„ nuchalis ..	..	3	..	..	..	..	8	..	..	20	7	3	..	41
28	„ forsteni ..	..	..	..	..	..	..	1	..	..	..	..	..	..	1
29	Dryophis perroteti	..	..	..	..	..	..	..	5	34	18	..	..	..	57
30	„ mycterizans	1	11	..	..	..	..	28	..	1	21	16	4	..	82
31	„ pulverulentus ..	..	1	..	..	..	..	1	..	..	..	..	..	..	2
32	Chrysopelea ornata	1	2	..	..	..	..	4	..	..	..	..	..	..	7
33	Bungarus cærueeus	...	..	..	..	..	..	..	..	..	2	3	..	..	5
34	Naia tripudians	1	..	..	..	..	..	1	..	..	9	..	..	1	12
35	„ bungarus	..	..	..	..	..	..	2	..	..	..	..	..	..	2
36	Hemibungarus nigrescens ..	..	12	1	..	..	2	3	1	4	28	7	..	..	58
37	Callophis bibroni	..	..	..	..	..	..	..	..	..	..	1	..	..	1
38	Vipera russelli	..	2	..	..	..	..	20	..	..	1	4	1	..	28
39	Echis carinatus	..	..	..	..	..	..	5	..	..	..	..	..	..	5
40	Ancistrodon millardi	..	..	..	..	..	..	11	..	..	..	..	..	..	11
41	Lachesis strigata	..	1	..	4	..	7	12	..	22	2	..	..	..	48
42	„ graminea	..	1	..	..	..	..	4	..	..	..	14	3	..	22
43	„ anamallensis ..	..	15	1	..	..	..	7	..	7	143	17	3	..	193
	Total ..	15	201	16	36	32	108	324	28	108	558	238	31	4	1,699

Family *TYPHLOPIDÆ.*

GENUS TYPHLOPE.

Fletcher's Blind Snake—*Typhlops fletcheri* (spec. nov.)
(After Mr. F. W. F. Fletcher of Rockwood).

Specimens of a *Typhlops* very like *braminus* were collected for me from Adderley, Pilloor, and Rockwood. They differ however from *braminus*, in that the suture below the nostrils passes to the 2nd labial instead of to the præocular. Although this is the only difference I can find, it is sufficiently important, I think, to claim for this the rank of a species apart from *braminus*. Of the hosts of true *braminus* I have examined I have never met with a specimen in which the lower suture from the nostril was aberrant, and all the species of the genus I know show wonderful constancy in the condition of the nasal shield, the nostril, and the sutures proceeding therefrom. It would be interesting to know if the many specimens in the British Museum referred to *T. braminus* collected by Colonel Beddome from the Anamallay and Tinnevelly Hills, have the peculiarity now pointed out by me.

Description—Rostral.—About one-third the breadth of the head, extending back to the level of the eyes. *Nasals.*—Not meeting behind the rostral ; completely divided ; the suture below the nostril shorter than that above, and passing to the 2nd labial. *Præfrontal, frontal* and *interparietal*—Subequal. *Supraocular, præ* and *postparietals*—Subequal. *Præocular*—About as large as the ocular ; in contact with the 2nd and 3rd labials. *Ocular.*—Large, in contact with the 3rd and 4th labials. *Suboculars.*—None. *Temporal.*—One. *Labials.*—Four. *Costals.*—In 20 rows.

The eye is beneath the suture dividing the ocular and supraocular shields, and is distinct. The nostril is inferior. The tail ends in a small acute spine. The diameter of the body is 1/40 to 1/45 the total length.

Colour.—Dark uniform purplish-brown above paler beneath, where the scales are pale brown except in the basal third which is deep plum coloured.

Length.—Three apparently adult specimens measure respectively $5\frac{7}{8}$, $5\frac{5}{8}$ and $5\frac{3}{8}$ inches. One younger is $4\frac{1}{2}$ and two others $2\frac{3}{4}$ inches.

Habitat.—The Nilgiri Hills at an altitude of about 3,000 to 6,000 feet.

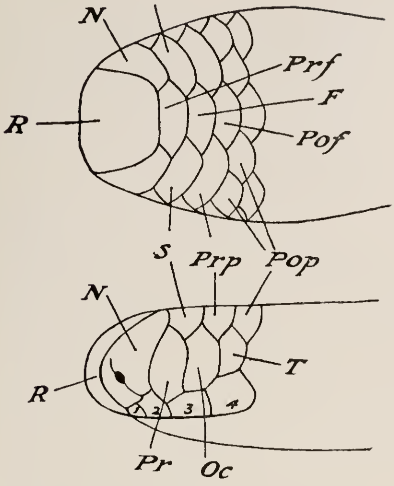
Beddome's Blind Snake—*Typhlops beddomii* (Boulenger).

I obtained one specimen only of this little known species from Pilloor and this was recovered from the stomach of a small *Hemibungarus nigrescens*. It measured $5\frac{1}{2}$ inches.

As the specimen is damaged from digestion there is an element of uncertainty in the identification. The following points which can be clearly made out point to the specimen being Beddome's blind snake, *viz.*, the rostral is about one-third the width of the head, the nasals meet behind the rostral, are quite divided, and the lower suture from the nostril is about three or four times as long as the upper. Scales in 18 rows. Diameter of body is about 1/42 the total length. On the other hand the lower suture from the nostril passes directly backwards to the præocular (Boulenger's plate in his catalogue, Vol. I, 1893, Plate 1, fig. 3, shows this passing to the 2nd labial). The eyes are invisible. The colour is a pale flesh tint. If the identification is correct this is the first record of this species in Hills North of Palghat Gap.

Thurston's Blind Snake—*Typhlops thurstoni* (Boettger).

When Boulenger's Catalogue appeared there were only two specimens in the British Museum. It is satisfactory to record that I have now obtained three more good examples, all from Rockwood Estate, Wynaad.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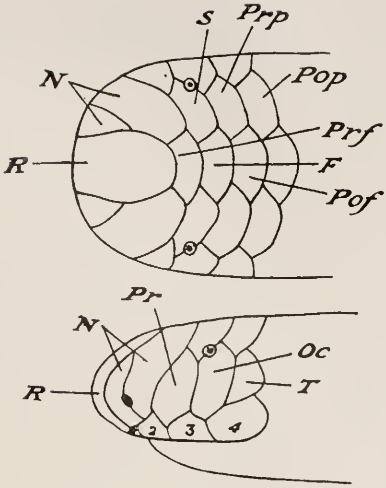
TYPHLOPS THURSTONI (× 5)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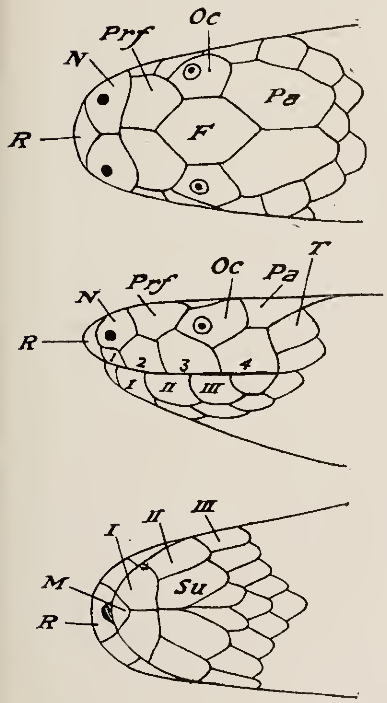
TYPHLOPS FLETCHERI (× 6)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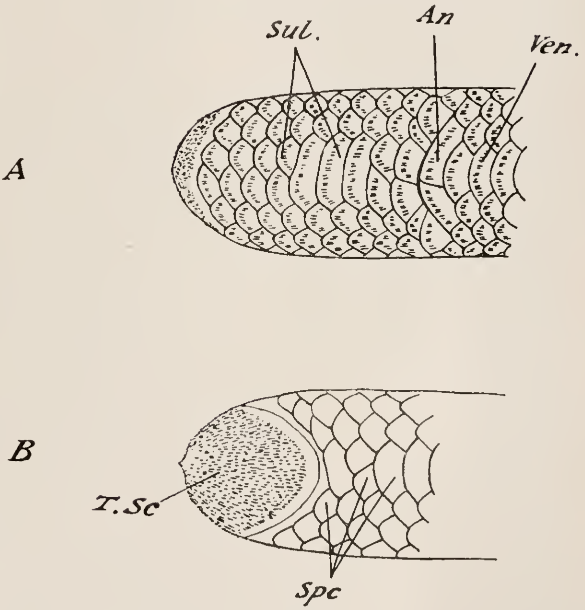
MELANOPHIDIUM WYNADENSE (× 2½)


Sul.
An
Ven.
A
B
T.Sc
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A.—Ventral aspect of tail.
B.—Dorsal aspect of tail.

RHINOPHIS SANGUINEUS (× 2)

NILGIRI SNAKES.

They agree very well with the description given in *Boulenger's* Catalogue (Vol. I, p. 26) except that my specimens are much more slender, the diameter of the body being respectively about 1/75, 1/64, and 1/82 the total length.

My specimens measured 12½, 10¼ and 9¾ inches.

I give two drawings of the head shields.

Family *UROPELTIDÆ.*

Beddome's Shieldtail.—*Rhinophis sanguineus* (Beddome.)

All my specimens, 40 in number, came from the Wynaad where it is evidently a common species.

Food.—Many contained fragments of earth worms in the stomach, and the intestines were nearly always loaded with semi-liquid mud from their victims' alimentary systems. The fact that the worms were found in fragments suggests that when seized they break themselves free by their struggles, only to be recaptured, and repeat the process.

Sexes.—Of 35 sexed 16 were ♀ and 19 ♂. The following sexual differences were noted. In females the body is rather longer and the tail shorter than in the male. This is seen by the ventrals in the former ranging from 214 to 218 against 200 to 213 in the male, and the subcaudals numbering 5 to 7 in the female against 9 to 11 in the male. In the male also the last ventrals, the last scales in the lowest 3 rows of costals, the anal, and the subcaudal shields are pluricarinate. The keels are rather indistinct, and only seen on a subterminal zone on these shields (see figure). There is no trace of these keels in the female.

Breeding.—Although I got no gravid ♀, many juvenile specimens with open navels prove that the young embark on life late in July, August, and September.

Growth.—No less than eleven were young of the year, and varied in length from 4¾ to 5½ inches. No specimen between 5½ and 10 inches was obtained so that it would appear that the young double their length in the first year of life. Nearly all the specimens were from 11 to 13 inches long. One ♀ measured 16 and one ♂ 14 inches. The rule in Colubrines is for the young to be about one-fourth the average adult measurement.

Colour.—No young specimens were brightly marked with coral-red ventrally. Only a faint tinge of pink was seen until adult life in this region.

Lepidosis.—In most specimens several of the subcaudal shields were entire.

The skin strips off this snake as easily as from others, except on the end of the tail. Here the modified skin on the terminal scute is so intimately adherent to the terminal vertebræ, that it is only removed with considerable difficulty.

Dentition.—The maxillary teeth number 5. There are no teeth in the palatine, and pterygoid bones. The mandibular set number 5.

The Argus Roughtail.—*Silybura ocellata* (Beddome).

This is an even commoner species than the last in the Wynaad (including Liddelsdale), my aggregate being 101. No specimen reached me from any other locality.

Food.—This consists entirely of earth worms, and the remarks made under the diet of the last species apply equally well to this snake.

Disposition.—I had a few live examples sent me, and I found them all very inoffensive creatures. They are rather restless in one's grasp, and push their noses through and through the clefts of the fingers. I put them on to loose earth, and found sometimes they would burrow, and at other times they remained inert, making no attempt to glide away. They move very slowly. Those that burrowed used the snout only for this purpose, and I am still perplexed as to the use of the curious tail. This is so often coated with mud when other parts of the snake are not, that I had expected the use of this appendage in some way whilst probing beneath the soil.

The sexes.—Of 23 that were sexed 16 proved to be ♀ and 7 ♂. The tail in the male is longer, the subcaudals numbering 9 to 11, against 7 to 8 of the female, but the body is but little shorter in the male. The male ventrals numbered 185 to 196 as compared with 194 to 208 (usually over 200) in the female.

Breeding.—I had two gravid females captured between the 20th of June and 10th of July. One measuring 11 inches contained 3 sacs with well developed embryos about $4\frac{3}{8}$ inches long. The other measuring $14\frac{1}{2}$ inches contained 5 sacs in which embryos $4\frac{1}{2}$ inches long were observed. A few young of the year measuring from 5 to $6\frac{1}{2}$ inches reached me in July and August.

Length.—I had four females 15 to $15\frac{3}{4}$ inches long, and my largest males measured 13 and $13\frac{1}{4}$ inches, respectively.

Dentition.—Maxillary set 4 or 5. Palatine and pterygoids edentulous. Mandibular set 6 or 7.

The Common Roughtail—*Silybura brevis* (Gunther).

All my specimens, 59 in number, came from the Wynaad.

Habits.—The few live specimens sent to me were as inoffensive as the last species. In captivity it burrowed with the aid of the snout alone, and nothing in its behaviour suggested any special use for the stumpy curiously-fashioned tail. In this species again I repeatedly noted that the top of the tail was clogged with earth when none was adhering to other parts.

Food.—Most examples contained fragments of earthworms in the stomach. The overloaded condition of the intestines with liquid mud gave one an idea of the heavy toll exacted from the ranks of its fellow sojourners beneath the soil.

Sexes.—Of 26 examples in which the sex is recorded, 14 were ♂ and 12 ♀. I was unable to discover any external characters to differentiate the sexes. Females as usual attain to a greater length, no less than 10 examples reaching or exceeding 11 inches, whereas only one male had acquired this length. My largest female measured $16\frac{1}{4}$ inches, and my largest male 12 inches.

Breeding.—I had no single gravid female, but the season for the appearance of the young is evidently from June to August. I had 21 young varying from $3\frac{7}{8}$ to $5\frac{1}{2}$ inches from the end of June onwards. They probably grow three inches in the first year as twelve specimens ranged from $6\frac{7}{8}$ to $8\frac{3}{4}$ inches.

The young examples I noticed had no trace of the terminal points, that one sees so well developed in the adult, and the supracaudals are less evidently carinate.

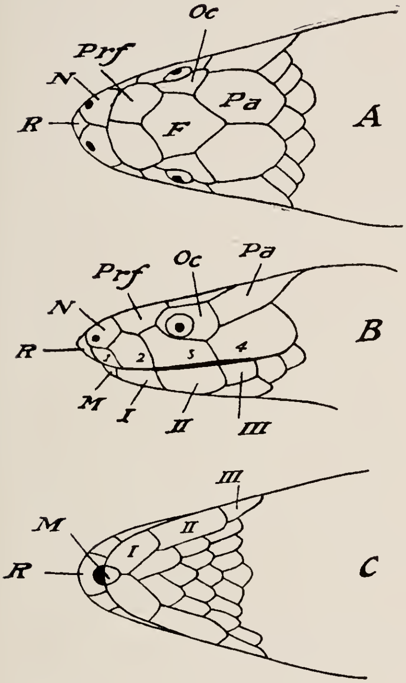
Lepidosis.—The range of ventrals I found to be 133 to 145 for the ♂ and 139 to 143 for the ♀. The subcaudals in the ♂ being 9 to 12, and in the ♀ 9 to 10. One specimen had the 7th, 8th and 9th subcaudals entire.

The skin strips off easily everywhere except on the truncate part of the tail. Here the epidermis is thicker than elsewhere, and intimately adherent to a cushion of deep musculature. Within this no osseous thickening is to be observed but the vertebræ are probably peculiarly Uropeltid.

Dentition.—The maxilla holds from 5 to 6 teeth. The palatine and pterygoid are edentulous. The mandibular array is 7.

Perrotet's Spinetail—*Plectrurus perroteti* (Dumeril and Bibron).

Boulenger in his Catalogue (Vol. I, p. 162) under the heading *P. davisoni* suggests that this species may have to be united with *perroteti*. I think there is no question that *davisoni* cannot be retained as a species apart. No less than 135 examples of this snake came into my hands, and from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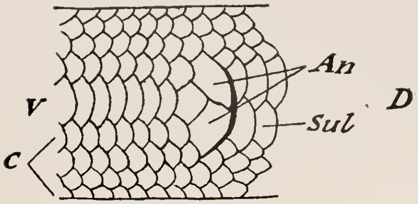
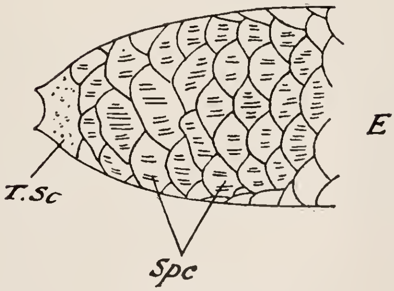


D.—Ventral aspect of tail.
E—Dorsal aspect of tail.



SILYBURA BREVIS (× 3)

NILGIRI SNAKES

this large material I am also inclined to doubt the validity of the other two "species," *viz.*, *guentheri* and *aureus*. Without however studying the type specimens it is wisest to say no more.

Habits.—Several live specimens were brought in, some having been encountered crossing the roads, and showing so little alarm at the approach of footsteps as to permit easy capture. In one's grasp it glides through the fingers restlessly and slowly without attempting to bite. One wreathed itself round a stick that was placed over it, and was carried so, for a mile or more without relaxing its folds. It exhibits considerable strength when wreathed round one's fingers.

Put into loose earth it burrowed with its nose so as to conceal its head, frequently leaving most of the body uncovered. No use was made of the tail while burrowing.

Sexes.—Of 38 sexed, 28 were found to be females and 10 males. I could discover no external differences to distinguish the sexes.

Breeding.—It is viviparous in habit. I obtained four gravid females between the 29th of June and the 3rd of August. In a specimen captured on the 29th of June six embryos were found measuring about 3 inches. In another between the 1st and 4th of July four embryos measuring about 2 inches long were observed. In a third caught on the 8th of August three young were found, all males, $4\frac{1}{16}$, $4\frac{1}{4}$ and $4\frac{1}{4}$ inches long. The fourth killed between the 1st and 3rd or August contained three fœtuses (two of which were males, and the third of uncertain sex one of which measured $3\frac{1}{16}$ inches). The young escaped from one mother partly by their own movements when she was cut open. A specimen in Gray's collection, date of capture unknown, contained six eggs.

I have always been puzzled to know when the genitals of male fœtuses became ensheathed. Up to a certain period they are found extruded before birth. I was able to observe that in the three most advanced fœtuses ripped from their mother, although males (ventrals and subcaudals 166+12, 167+12 and 167+11), the genitals were no longer extruded so that the ensheathing takes place before birth. The mothers varied in length from 11 to 14 inches.

The season of birth is from June to September. I obtained 3 specimens $4\frac{3}{8}$, $4\frac{5}{8}$ and $5\frac{1}{4}$ inches long in June, and as many as 15 varying from 4 to $4\frac{3}{4}$ inches in September. As many as 40 specimens of this year's production were collected.

Food.—Earthworms form its exclusive dietary, many of these being found in fragments "in gastro". The intestines were almost always filled with liquid mud.

Colour.—In some specimens there is a bright carrot red hue on the centres of the scales of the belly and beneath the tail instead of the usual mustard-yellow. In the young a pale pinkish shade replaces these brighter hues.

One specimen furnished me with several white vermiform parasites which appeared to me identical with the *Porocephalus crotali* so frequently found infesting the abdominal cavity of Colubrines. One of these was half obtruded from the cloacal orifice which would make it appear an interalimentary parasite, sometimes though usually found attached to the walls of the abdominal cavity, or outside the various viscera.

Lepidosis.—The ventrals in the ♂ varied from 160 to 167, in the ♀ from 162 to 181. The subcaudals in the ♂ from 9 to 12, in the ♀ 6 to 8.

Habitat.—It is an extremely common snake between 5,000 and 6,000 feet, and gets scarcer as one approaches 3,500 feet. This accounts for the small number (only five) of specimens from the Wynaad.

Dentition.—The maxillary teeth number 7. There are no palatine, and no pterygoid teeth. The mandible holds 6 or 7.

The Black Burrowing Snake—*Melanophidium wynadense* (Beddome).

This species is apparently less rare than museum collections would make it appear. I managed to obtain 26 specimens, though the British Museum has only 3 representatives.

Sexes.—No external differences to denote the sex were observed by me. Of 8 sexed, 5 were ♂ and 3♀.

Food.—Earthworms form the exclusive diet, most specimens having fragments of these in the stomach. The intestines were loaded with liquid mud.

Breeding.—No gravid female was secured. Young of the year measuring from 5 to 6½ inches were obtained in July (4), August (2) and September (3).

Length.—My longest taped 17 inches and was a ♂. I had two other males of 16½ and 16¾ inches in length, and a female 16¼ inches long.

Colour.—The irregularly-distributed, light, ventral patches were quite white, not yellow as supposed by Boulenger.

Lepidosis.—The ventrals ranged between 170 and 184, and the subcaudals between 10 and 13. No sexual differences can be established.

Habitat.—All were captured in the Wynaad.

Dentition.—There are 8 maxillary teeth. The palatine and pterygoid bones are edentulous. The mandibular teeth number 8.

Family *COLUBRIDÆ.*

SUB-FAMILY COLUBRINÆ.

The Chequered Water Snake—*Tropidonotus piscator* (Schneider).

Forty-three examples of this common snake reached me. Mr. Oakes sent me two from his garden near Ootacamund at 6,300 feet elevation. This is a remarkable altitude to find a denizen of the Indian Plains flourishing.

Food.—Many had recently fed and in every case a frog had been taken. An *Ixalus* (Spec?) once, *Rana limnocharis* three times, (one specimen having devoured four small ones), and in three other examples the frogs were too digested to identify.

Young.—Three young of the year were obtained in June varying from 7¾ to 8¾ inches in length, five in July from 9 to 11 inches, eight in August from 9¼ to 13½ inches, and two in September from 11 to 11½ inches.

Varieties.—All were marked with small, and ill-defined, dark, chequerings, some being nearly uniform in colouration. In some a pale chequering was more evident than the dark. Several were adorned with a bright pinkish suffusion at the edge of the ventrals, and some with bright rose chequering in the flanks. These bright hues were seen in young of the year, as well as adults, and one young specimen of 7¾ inches showed a bright canary throat, this hue extending to the sides of the neck. The entozoon *Kallicephalus willeyi* was seen in large clusters in the stomachs of nearly all.

Beddome's Grass Snake—*Tropidonotus beddomi* (Gunther).

This species seems to be equally common throughout the Nilgiris, and the Wynaad, one hundred and fifty-seven specimens having been collected. It will be seen from the synopsis that it inhabits a zone between 3,000 and 7,000 feet.

Sexes.—Of 123 specimens sexed, 54 were ♂ and 69 ♀.

Food.—Frogs proved the favourite diet, but occasionally small toads were taken. Fifteen examples were found to have swallowed frogs, and twelve of those had feasted on species of *Ixalus.* On three occasions two *Ixalus* were found, on one three, and on one four. In other cases the frog was too far digested to identify. In one specimen I found a mass of frog's eggs, with the prospective mother in a state of dissolution. Once I found a young *Bufo melanostictus* and once the legs of a toad that was probably the same species. This diet sheds light on the haunts of

Beddome's grass snake for *Ixalus variabilis* by far the commonest species, I found inhabiting marshy ground, or water cuts where arum lilies and wild caladiums grew. The hollow stems of these plants where they embrace the stalk were found tenanted by this frog in great numbers.

Breeding.—Many examples were egg-bound, and these are best tabulated. It will be observed that of the 21 gravid females, 16½ inches was the smallest length, and 27¼ inches the largest. From 5 to 9 eggs are usually produced, but they varied from 3 to 11. The embryos attain some degree of development before oviposition. It will be seen later that young of the year commenced to appear in June, and continued to the month of September. The fact that many females were egg-bound in the latter month shows that the season for the young to hatch extends probably to November.

Date.	Length of mother in inches.	No. of eggs.	Remarks.
20-6-17 to 5-7-17.	21	6	Eggs, ¾″ to 1″ in length.
,,	16½	5	
,,	19¾	6	Eggs, ¾″ to 1″ in length.
7 to 10-7-17.	22	9	Eggs, ¾″ to 1″ in length.
10 to 25-7-17.	17½	7	Tail deficient. Eggs, 1″ long.
,,	18¾	6	
25-7-17 to 3-8-17.	22	8	Eggs, 1″ long, with minute embryos inside.
1 to 3-8-17.	27¼	8	
1 to 6-8-17.	20½	3	
6 to 12-8-17.	....	7	
,,	20½	10	
,,	18	5	Eggs about 1" long with minute embryos inside.
12 to 24-8-17.	....	7	
,,	....	8	
15 to 18-8-17.	24¼	7	
15 to 20-8-17.	23½	6	Follicles enlarged, not much advanced.
,,	....	8	
,,	....	7	
9 to 11-9-17.	25	9	
17 to 23-9-17.	....	8	
1 to 20-9-17.	....	11	

Growth.—Seventeen young of the year varying from 5½ to 10 inches were captured in the months of June to September, both these outside measurements occurring in the last month. Nothing longer than 7 inches was procured before September though eight of this year's progeny were caught before this month. Seventeen other specimens between 14¾ and 17½ inches were secured, evidently last year's production, but the lengths exceeding 17½ inches are so gradually, and evenly progressive that it is impossible to follow the growth any further. The largest specimen was a ♀ 27¼ inches in length, and the average of the six largest of this sex was 25 inches against 22 inches for the average of the six largest ♂. The largest ♂ measured 25 inches.

Lepidosis.—The ventrals, and subcaudals were only noted in a few cases and show no difference in the sexes. Thus in the ♂ the ventrals were 141 to 150, in the ♀ 139 to 147. The subcaudals in the ♂ were 69 to 81, and in the ♀ 62 to 81.

Dentition.—The maxilla holds from 24 to 25 teeth behind which is a gap followed by 2 teeth fully twice the length of the preceding. The palatine teeth number 18 to 19, the pterygoid 33 to 38, and the mandibular 32 to 33.

The Buff-striped Keelback.—*Tropidonotus stolatus* (Linnè).

In all 52 specimens of this snake reached me. It is evidently a fairly common species up to 5,000 feet and occurs up to about 6,000 feet. Being a snake of the Plains it was to be expected that it would be found in the Wynaad as plentifully as in other parts of these Hills. Seven of the total were of the "red" variety, vermilion hues replacing the pale blue seen in usual specimens. This beautiful ornamentation was seen in three quite juvenile examples measuring respectively 8⅜, 11⅜ and 11 inches.

Breeding.—Five gravid females were included all captured in July, August, or September. The smallest dam measured 17 inches, and the largest 28½ inches. The clutches of eggs varied from 3 to 10. In one case the eggs were found to contain minute embroys which if unravelled might have been about one inch long.

Food.—Of the many that had but recently fed, two contained frogs with dilated toes that I think were *Rana temporalis*, three contained frogs too digested to recognise, and nine others species of *Ixalus*. One of these last had swallowed no less than six of this small batrachian.

Growth.—Twelve specimens were young of the year ranging between 6½ and 8⅞ inches during the months from June to September. The growth of the species is difficult to follow as the breeding season probably lasts during half the year.

Jerdon's Grass Snake.—*Tropidonotus monticola* (Jerdon).

All the 13 specimens of this uncommon snake were caught in the Wynaad. Unfortunately most were very juvenile, and some had their tails more or less deficient. The largest adult, a ♀ measured 22¾ inches.

Colour and markings.—In one young specimen there was a very bright yellow collar, and in all the specimens the throat and sides of the neck were yellow. This hue was replaced by a bright orange in the adult. Most of the supralabials had narrow blackish margins. The cross bars are sometimes very obscure, even in quite young specimens.

Food.—Three had their stomachs distended. A *Bufo melanostictus* had been taken by the large ♀, and a *Rana limnocharis* by two other examples.

Growth.—Seven of this year's production taken from July to September varied from $6\frac{1}{4}$ to $7\frac{3}{4}$ inches in length. Two others of 12 and $14\frac{1}{4}$ inches respectively, taken in September were evidently last year's broods. so that it about doubles its length in the first year of life.

Lepidosis.—In one the 7th labial was confluent with the lower temporal and did not descend to the margin of the lip. The postoculars were 4 on one side in one specimen, and the temporal single on one side in one specimen. The ventral count ranged between 133 and 141, and the subcaudal between 78 and 88.

The Green Keelback.—*Macropisthodon plumbicolor* (Cantor).

Mr. Vernede tells me his coolies call it "pacha naga" (="green cobra") a very appropriate name when one considers the degree to which it can flatten the neck cobra-wise.

This is one of the commonest snakes in the Hills, 106 examples having been collected. It favours an altitude between 3,000 and 6,000 feet; and was quite common at Kalhatti at 6,300 feet. Only 2 specimens came in from the Wynaad side out of the large total collected there. Of 39 sexed, 26 were ♂ and 13 ♀.

Colour.—The verdant-green hue is not due to a green pigment. It is due to a yellow pigment that overlies the scales as a sort of varnish, and which is soluble in spirit leaving the specimen blue. Some specimens are darker than others due to the varying abundance of the yellow pigment, and in these the scales are plumbeous when the pigment is removed. The inappropriate specific name *plumbicolor* is thus accounted for. The remarks made on the colour of the snake *Dryophis mycterizans* apply equally well to this species. I skinned a few, cleansed them in my bath with soap and water and placed them in spirit. In a few days a very distinct yellow tinge was imparted to the liquid, and as I boiled it down the colour became deeper and deeper, but I could not separate it out as a powder.

The skin strips easily as is usual with snakes. It is slate coloured on the inner side, and the integument around the last three or four costal rows is white. Short white lines are scattered through the skin becoming fewer up the sides of the body. Another very curious peculiarity I have seen in no other snake. I allude to an arrangement of small, extremely regularly-disposed, series of ring-like spots, on either side of the 9th and 10th costal rows above the ventrals. These are placed at the angles of the scales referred to, are in the integument itself, and if looked for can be seen from the epithelial surface. Where the rows in midbody are 25, five rows intervene vertebrally between these spots, and where 27, seven rows.

Food.—A remarkable partiality in diet is shown towards the toad *Bufo melanostictus*. No fewer than ten had swallowed this batrachian, and two of these were quite young specimens. One adult had accounted for two, and another for three large specimens. In some cases the distension was extraordinary. For instance a snake measuring three inches in girth was five and a quarter inches round the gastric region, and found to contain a toad with a head fully twice the transverse diameter of that of the host's ! Frogs were taken by three examples, once *Ixalus variabilis*, and once a species probably of *Ixalus*.

Breeding.—It seems rather remarkable that no single specimen proved gravid. I have definitely ascertained (and reported in this Journal, Vol. xvi, page 390) that the young hatchling varies from $5\frac{3}{8}$ to about $6\frac{1}{2}$ inches. I got one measuring $6\frac{5}{8}$ inches in August, and twenty others, young of the year, varied from $7\frac{1}{4}$ to 10 inches in the months of August and September.

Growth.—What I take to be last year's broods were represented by two specimens 15 and 15¾ inches long. My largest example measuring 33 inches was a ♀, another of the same sex was 31½ inches, and a third 29¼ inches. The largest ♂ was 29½ inches.

Parasites.—I found two young specimens infested with small scarlet mites (*Trombidia*) which had fastened themselves chiefly on to the skin between the ventral shields. These I submitted to Dr. Annandale.

Dentition—The maxilla holds 12 teeth after which there is a short gap, followed by two large teeth more than twice the length of the preceding. The palatine teeth number 7, the pterygoid 13 to 14, and the mandibular 16 to 19.

The Olivaceous Smooth Snake—*Rhabdops olivaceus* (Beddome).

Five specimens of this uncommon species reached me, all from the Wynaad. The belly is a dirty yellowish hue peppered with olive-green especially at the bases of the ventrals; and subcaudals. A black narrow zigzag line runs along the ventrals. Three were ♂ and two ♀.

Breeding.—My largest example captured in September was gravid. Eleven follicles (five in one ovary and six in the other) being distinctly enlarged. The specimen measured 30¾ inches.

Lepidosis.—The ventrals in the males ranged between 210 to 213, in the females 202 to 207. The subcaudals in the males ranged between 69 and 74, and in the females 63 to 64. The præoculars (two, Boulenger Cat. Snakes Brit. Mus., Vol. 1, page 300) are subject to variation. In three specimens the loreal by a confluence with the lower præocular touched the eye, and in one specimen the præfrontal touched the eye owing to the confluence of this shield with the upper præocular, in addition to the confluence of loreal and inferior præocular. This is the subject figured by me.

Perrotet's Dwarf Snake—*Xylophis perroteti* (Dumeril and Bibron).

Of the 61 specimens collected many came from the Wynaad. It is common at an altitude above 5,000 feet as will be seen from the numbers taken at Kalhatti, Frith Hall and Coonoor. Mr. Rogers too told me that his specimens were all taken from the higher parts of his estate. Of 47 sexed 18 were ♂ and 29 ♀.

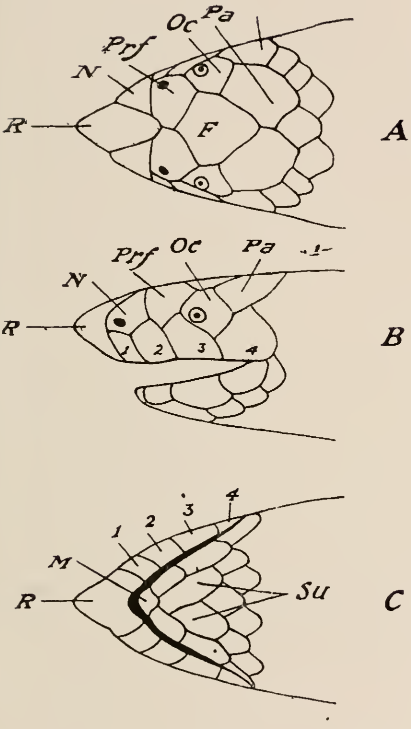
Food.—It subsists entirely on earth worms, and every specimen opened had either fragments of worms in the stomach, or the intestinal tracts loaded with mud from this diet. One specimen 21 inches in length was found to contain a very large worm (*Moniliventer grandis ?*) 12½ inches in length lying fully extended in the gullet and stomach.

One specimen 20 inches in length was recovered from the stomach of a *Hemibungarus nigrescens*.

Breeding.—Four gravid females were included in the total, all killed in July. They varied in length from 17 to 21 inches. The eggs found within numbered from 6 to 12 and contained minute embryos estimated at about one inch long if unravelled. The eggs were one to one and a half inches long. One specimen contained a single large unfertilised egg. I think the eggs are probably deposited as such, but cannot speak positively.

Growth.—I had eight young of the year ranging between 5¼ and 8 inches in June, July and August. Fifteen other examples between 12 and 16 inches were probably last year's brood. The ♀ attains to a greater length than the ♂. I had no ♂ specimen exceeding 20 inches but six ♀ were 21, 21, 21, 21¾, 23½ and 23¾ inches long, respectively.

The tail is distinctly longer in the ♂.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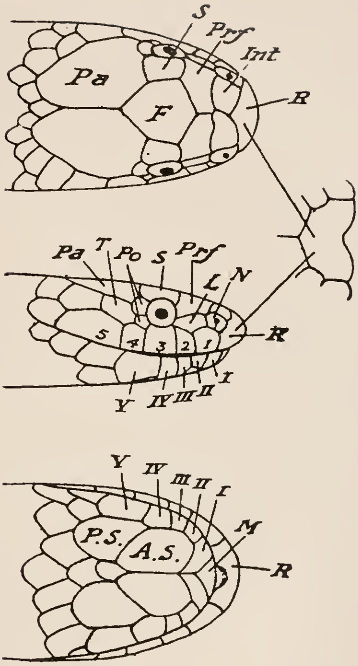
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RHABDOPS OLIVACEUS.
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NILGIRI SNAKES.

Lepidosis.—The ventrals and subcaudals show definite ranges in the sexes; thus the ventrals in the ♂ ranged between 133 and 141, in the ♀ between 143 and 150. The ♂ subcaudals were 25 to 40, and the ♀ 14 to 20.

Dentition.—The maxilla supports 28 to 31 teeth. The palatine array vary from 14 to 18, the pterygoid 32 to 34, and the mandibular 26 to 31.

The Common Wolf Snake—*Lycodon aulicus* (Linne).

Only 7 of this very common snake were collected, showing that it does not favour the Hills. The highest altitude was 5,700 feet.

Varieties.—Three conformed to the usual variety *typica* of Linné, one to Boulenger's variety B, and three others 1 would place with Boie's Variety *unicolor* in spite of the fact that all had bright yellow collars from which a moustache-like stripe of the same shade was thrown forward to meet in front of the rostral. Otherwise these very strikingly handsome specimens had no trace of marks. The body was a very deep purplish-brown almost chocolate. These three specimens came from Coonoor, the cart road below Coonoor, and from Pilloor. I have never seen this variety before. In Boulenger's variety B, the crossbars were 11 and the first interval involved 27 scales vertebrally. In the typical variety the bars ranged from 15 to 25.

Food.—One had eaten a skink which I think was a *Mabuia*.

Lepidosis.—In the two specimens of *unicolor* (Boie) where the ventrals and subcaudals were counted they were ♀ 227 and 69, and 222 and 67 (?) In Boulenger's variety *B* these shields numbered 179 (?) plus 62.

The Hill Wolf Snake—*Lycodon travancoricus* (Beddome).

The 65 specimens collected were as common in the Wynaad as in the Nilgiris. The species is found up to 6,000 feet, and beyond. Three or four of those brought in came with an account of having been killed inside houses in Coonoor.

Sexes.—Of 31 in which I have recorded the sex 21 were ♂ and 10 ♀.

Colour.—All the specimens that reached me freshly killed had the crossbars, and variegations in the flanks of a bright yellow colour. The yellow in all Lycodonts is very unstable, losing its colour after a few hours immersion in spirit.

Food.—A large number had recently fed, and a great partiality is shown for a lacertine diet. Frogs of the genus *Ixalus* had on three occasions furnished the meal. The lizards were of varied sorts. Geckos had twice been taken, *Lygosoma* ten times, a *Mabuia* on three occasions, and a *Charasia* (probably *dorsalis*) twice. Two other lizards were too digested to recognise.

Breeding.—Not a single female specimen showed any enlargement of the ovarian follicles. The hatching season can be arrived at however in the following manner. This species grows to the same length as its congener *aulicus*, the young of which are known to be 6¾ to 7¾ inches long when hatching. Specimens within this range (of *travancoricus*) were captured in August and as specimens up to 11 inches were also bagged in the same month it is probable that they hatched out in May if not before. The season then is about May to August.

Growth.—Young of the year measuring 7½ to 7¾ inches (2) were obtained in June, 8 to 11 inches (8) in July, 7 to 11 inches (11) in August, and 9¼ to 11 inches (4) in September. Ten other specimens in the same months ranging between 16 to 18¼ inches were obviously last year's progeny, and show that the young double their length in the first year of life.

Anal glands.—These glands furnish an opaque yellowish fluid.

Parasites.—One specimen was infested with little scarlet mites apparently similar to those already alluded to which had attached themselves to specimens of *Macropisthodon plumbicolor*.

Lepidosis.—The labials in one were 10 in number on the left side. The temporals in one were three anteriorly on the right side.

Dentition.—The maxilla supports anteriorly 3 teeth progressively increasing in size, then 2 elongate subequal teeth about twice the size of the 3rd. After these there is an edentulous space that would take about 3 teeth. This is followed by from 9 to 11 small isodont teeth after which come 2 more elongate teeth about twice the length of the preceding. The palatine array number 13 to 17, the pterygoid 21 to 27. The mandibles have anteriorly 3 progressively increasing teeth, and then 2 elongate about twice the length of the 3rd. A small gap that would take about 2 teeth is followed by a series of small isodont teeth numbering 19 to 20.

The Dhaman—*Zaocys mucosus* (Linné).

This species 88 of which were acquired is a fairly common snake even at 6,000 feet elevation. It is probable a very much larger number would have been sent me had I not stipulated that such a bulky snake was not to be included. Nearly all the specimens sent me were in consequence quite young.

Food.—I remarked in my popular article in this Journal dealing with this snake that it was a gourmand with very varied tastes. This is fully borne out by these specimens. One had eaten a mouse, four others frogs, too digested to recognise, one a single *Ixalus*, one four *Ixalus*, and another six *Ixalus*. One contained an *Ixalus variabilis*, and a skink of the genus *Mabuia*. Another had swallowed a *Bufo melanostictus*, and a lizard of the genus *Lygosoma*.

Breeding.—There are no breeding events to chronicle, but a female 5 feet 10 inches in length, and in a very emaciated condition was killed in Coonoor on the 27th of June with a large swelling that proved to be an unfertilised egg. This measured 2⅜ inches in length, and 1 inch in breadth, and weighed just under ⅞ of an ounce. The hatching season in these Hills is evidently in the early months of the year probably March to May as may be judged by the dimensions of specimens brought in, coupled with the fact that this species is known to be about 14½ to 15½ inches when emerging from the egg. Young of the year measuring 19¾ to 20½ inches (4) were captured in June, 17½ to 20¾ inches (9) in July, 18 to 23 inches (19) in August, and 18¾ to 22 inches (6) in September.

The Trinket Snake—*Coluber helena* (Daudin).

One of the snakes called "kattu viriyan" (meaning "banded snake") by the Tamils. The total for this species was 107. It does not appear to favour an altitude above about 5,000 feet.

Sexes.—Of those in which sex is recorded 26 were ♂ and 18 ♀.

Food.—There were surprisingly few that had recently fed. A mouse had been swallowed by four examples, and masses of hair were found in the cloaca of a fifth. A frog of the genus *Ixalus* constituted the meal in one case.

Breeding.—No single ♀ showed any enlargement of the ovarian follicles. This may be accounted for possibly by my asking those helping me not to put large snakes into the tins supplied, as they take up so much room and expend so much spirit.

Growth.—Five young of the year ranging between 13 and 15½ inches were included in July, sixteen between 13 and 17¼ inches in August, and one 15¾ inches in September. Eleven other examples measuring from 20 to 23 inches were obviously last year's broods. Fourteen others from 30 to 39 inches seem to represent the progeny of the year before last. My largest was a ♀ 48½ inches in length.

Parasites.—Scarlet mites had attached themselves to two specimens, probably the same species already reported with reference to *Lycodon travancoricus*, and *Macropisthodon plumbicolor*.

Lepidosis.—The labials were 10 in one example with the 5th, 6th and 7th touching the eye. In one the 5th to the 9th subcaudals were entire.

One large specimen captured alive proved a very truculent creature to deal with. It buried its teeth in the butterfly net used to encompass its capture, and then got itself tied up in the net in a hopeless muddle.

Dentition.—The maxilla carries from 19 to 25 teeth, the palatine 10 to 14, the pterygoid 15 to 26 (? 30) and the mandible 22 to 30.

The Indian Bronze-backed Tree Snake—*Dendrelaphis tristis* (Daudin).

It is singular that this species which is so abundant in the Plains only furnished 6 representatives and it seems probable that they were from slopes below about 3,000 feet.

Sexes.—Three were ♂ and 3 ♀.

Food.—A frog of the genus *Ixalus* had been swallowed on two occasions.

Lepidosis.—The costals in all the ♂ reduced to 9 posteriorly, and in all the ♀ to 11. The ventral count for the ♂ was 179 to 181, and the ♀ 174 to 180. The subcaudal count for the ♂ was 133 to 159 and for the ♀ 145 to 154.

The Beautiful Kukri Snake—*Oligodon venustus* (Jerdon).

The 30 specimens procured show that the species favours an altitude between 5,000 and 6,000 feet and this probably accounts for the relatively few examples furnished by the Wynaad. It extends up to at least 6,500 feet.

The sexes.—Of 26 sexed, 12 were ♂ and 14 ♀.

Food.—Until this holiday in the Nilgris I had failed to discover the diet of the Kukri snakes as a group.

The few, and very minute teeth in the palatine, and pterygoid bones, seemed to indicate something peculiar in their choice of food, which I now find consists of reptilian eggs, frog's eggs, and snails. In two cases the stomach was distended with a mass of frog's eggs, in a third there were 16 eggs, and in a fourth 4 eggs, and a snail. In no case was any vestige of a frog ingested. Eggs of reptiles which may have been either snakes or lizards with soft shells had been eaten by four examples. In two cases a single egg was found, in one two eggs, and in a third three eggs. The size of these was about the same in each case being about ¾ of an inch in length. These eggs were invariably flat, and empty, and in some cases were found embedded in a mass of coagulated yolk, the nature of which puzzled me till I discovered an egg-case embedded therein. One specimen had swallowed a snail with a white shell very little damaged. In another amorphous masses were found of the consistency of a cooked meally potato, and the nature of the material would have remained unsolved but for fragments of snail shell adhering. In one such mass small grits and the remains of insects were discovered evidently the contents of a snail's stomach.

Breeding.—No gravid ♀ came in, but from the measurements of young it would appear that the season for the appearance of the broods is June, and the closely preceding months.

Growth.—One young of the year 4½ inches long reached me in June, and another 6½ inches long in August. Four other juvenile examples ranging from 9½ to 10½ inches in August and September, I take to represent last year's broods. My largest specimens were a ♀ 19½ inches and a ♂ 17 inches.

Lepidosis.—I found the loreal shield absent in 11 specimens on both sides, and in 3 others on one side. The 6th labial failed to touch the margin of the lip in 17 examples on both sides, and in 2 others on one side. In one the 6th and 7th labials were completely confluent. The ventral and subcaudal counts (including 5 ♂, and 8 ♀ specimens in the late Mr. C. Gray's collection) were, ventrals ♂ 142 to 152, ♀ 152 to 165. Subcaudals were ♂ 31 to 35, ♀ 27 to 34.

Dentition.—The maxilla supports 7 to 8 teeth progressively increasing from before backwards. The palatine has from 1 to 3 very small teeth in the middle. The pterygoid has from 4 to 8 teeth after an edentulous anterior space. The mandible has from 9 to 11 teeth.

The Wynaad Kukri Snake—*Oligodon affinis* (Gunther).

The Wynaad furnished all my 11 specimens.

Sexes.—Of 9 sexed, 4 were ♂ and 5 ♀.

Growth.—One example 4 inches long was captured in July. All the others were adults, the ♂ specimens ranging between 11½ and 12¾ inches in length, and the ♀ between 10⅝ and 13 inches.

Colour.—The young specimen was coloured exactly like adults. In adults the crossbars are narrow and well-defined, and numbered from 33 to 41.

Lepidosis.—Though the loreal is usually wanting I got two examples with a small loreal on both sides, and one with a loreal on one side. The labials were constantly 7, the 3rd and 4th touching the eye. The ventrals in the ♂ ranged from 135 to 140, and in the ♀ from 135 to 141. The subcaudals in the ♂ were 32 to 34, and in the ♀ 25 to 28. In at least 5 examples the costal rows had reduced from 17 to 15 at or before midbody.

Dentition.—The maxilla bears 17 teeth progressively increasing from before backwards. The palatine has 1 tooth about its middle. The pterygoid has 4 teeth with an edentulous space before them. The mandible has 8 teeth.

The Common Kukri Snake—*Oligodon subgriseus* (Dumeril and Bibron).

The total of this species reached 47, and the fact that 41 of these came from the Wynaad is difficult to explain. It evidently does not come much above 5,000 feet elevation.

Sexes.—Of the 28 sexed, 10 were ♂ and 18 ♀.

Breeding.—No female was gravid, but the season for the appearance of the young can be inferred by the following facts.

In this Journal (Vol. xix, p. 561) I recorded a young one 4·8 inches long that I thought a hatchling. This was killed in March in Cannanore. As will be seen below all my young this year taken from June to September were considerably longer, and indicate that they hatched out much earlier in the year, probably January to March.

Food.—Like *venustus* its diet consists of lizard's (snake's?) and frog's eggs. Four soft-shelled eggs were found in one specimen, about $\frac{5}{8}$ of an inch in length, their contents absorbed, and the egg-envelope collapsed. Another contained a yellow sausage-shaped mass that was almost a cast of the stomach. It measured $4\frac{1}{2}$ inches and when broken into was found to contain 5 soft shelled, empty, egg envelopes from $\frac{5}{8}$ to $\frac{3}{4}$ inches in length. These were embedded, and concealed in the coagulated yolk-mass. A young specimen $6\frac{1}{4}$ inches long also contained in its stomach a mass of coagulated yolk in which one soft-shelled, and empty egg-case $\frac{3}{4}$ inch long was embedded. A fourth specimen contained a similar yolk-mass but no egg envelope was discovered therein. A fifth specimen contained three very small lizards, the bodies of which measured about $\frac{3}{4}$ of an inch, and the tails a similar length. Flocculi of coagulated yolk adhered to them, and there seems little doubt that the snake had discovered eggs just on the point of hatching, and probably liberated the occupants in its endeavour to swallow the eggs. A mass of frog's eggs distended the stomach in one example, with no trace of the frog.

Growth.—Young of the year were represented as follows:—One $6\frac{7}{8}$ inches long reached me in June, five varying from 6 to $7\frac{1}{4}$ inches in August and eight measuring from $6\frac{7}{8}$ to $9\frac{1}{4}$ inches in September. My largest ♂ taped $19\frac{1}{2}$ inches and ♂ 18 inches.

Colour.—The crossbars consisting of more or less confluent quadrimaculate parts numbered 16 to 22 on the body, and 3 to 4 on the tail. Dark variegations are often grouped so as to suggest crossbars in the intervals.

Lepidosis.—I found the loreal absent in one specimen, and two anterior temporals in another. In one other example the 4th to 8th subcaudals were entire.

The Western Reed Snake—*Ablabes calamaria* (Gunther).

Evidently an uncommon snake, only 5 specimens having been acquired. Four of these were from the Wynaad. There is nothing special to note since all accord well with Boulenger's description. One specimen 5 inches long in August had 132 ventrals and 70 subcaudals. In another $8\frac{5}{8}$ inches long, these shields were 139 + 57. In a third $8\frac{7}{8}$ inches long 126 + 59, in a fourth ♂ (?) $9\frac{3}{4}$ inches 127+64, and in a fifth a ♀ (?) $10\frac{1}{4}$ inches 135+53.

Dentition.—The maxilla bears 24 teeth, the palatine 15, the pterygoid 16, and the mandible 18.

The Brown Tree Snake—*Dipsadomorphus trigonatus* (Schneider).

Only 3 specimens were received, and this being so, it is strange that tw of these should have come from such an altitude as Frith Hall Estate One had swallowed a lizard of the genus *Calotes.*

The Hill Tree Snake—**Dipsadomorphus ceylonensis* (Gunther).

In the paper referred to in the footnote I gave in tabular form a series of 21 specimens characterised by costals in midbody 19, ventrals varying from 214 to 235 and subcaudals 98 to 109. Between 1909 and 1917 I received from Ceylon and the Hills of South India 11 more specimens with costals 19, ventrals 209 to 240, and subcaudals 94 to 107. This year I have acquired 40 more specimens with costals 19, ventrals 214 to 239, and subcaudals 94 to 110. In the aggregate then, I have had 72 specimens with costals 19, ventrals 209 to 240, and subcaudals 94 to 110.

Habitat.—All except seven of these were captured in the Wynaad.

Sexes.—Of 33 sexed, 19 were ♂ and 14 ♀.

Food.—Frogs had been swallowed by five examples, once a *Rana limnocharis*, and twice a species of *Ixalus*. Seven other specimens had eaten lizards, three *Salea horsfieldi*, and one a *Calotes versicolor*.

Breeding.—In August I got two females in each of which 7 follicles were impregnated. In September four other females were egg-bound, the numbers of eggs varying from 5 to 8. These, very elongate in shape, measured one inch long in a specimen killed during the last ten days of that month. The prospective dams measured from 32½ to 34 inches, (length of two not recorded), a length it would appear they attain at the end of the second year of life.

Growth.—Three examples in August and September measured from 12½ to 15½ inches, four others from 20 to 25½ inches, 10 others from 31⅛ to 39 inches, and six others from 44½ to 50½ inches. These various ranges appear to denote the broods of successive years.

My largest ♂ was 50½, and ♀ 34 inches.

Lepidosis.—In three specimens the scale rows were found in places to be 21 for a brief interval or intervals, but when critically examined it was found that at these spots the costals remained the same. One or more shields in succession in the vertebral row were divided into three and accounted for the increase to 21, and I find this tendency in certain individuals of all the species of this genus of which I have examined a large series. Posteriorly the costal rows reduce to 15 with great consistency.

Dentition.—The maxilla in Nilgiri specimens supports from 18 to 20 teeth followed after a short gap by 2 large, grooved, and obliquely-placed pseudo fangs. (In Ceylon specimens there are only 14 to 15 teeth anteriorly). The palatine has 9 teeth. (In Ceylon specimens 7 to 8). The pterygoid has 19 ? to 21 teeth (Ceylon specimens 18 to 20). The mandible holds 25 to 28 teeth (Ceylon specimens 21 to 24).

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* In 1909 I published a note in the Records of the Indian Museum (pages 151 *et seq.*) upon certain "forms" of *Dipsadomorphus*. I expressed the view that *ceylonensis* (Gunther) as described in Boulenger's Catalogue (Vol. iii, p. 66) includes four distinct "forms," and gave in tabular form the shield characters for each upon which reliance is mainly placed in the separation of the species of this genus. I suggested that they should each receive recognition as distinct species. Dr. Annandale in a later issue of the same Journal (Vol. iii, part 111, p. 281) dissented from my views. The conclusions drawn by me from the rather small series of specimens of each "form" that I had examined when I wrote the paper referred to, are completely confirmed by the very much larger material now available with regard to two of those "forms". The others (one from Ceylon, and one from the Andamans) do not concern us here. The fact that there is some slight overlapping in the ranges of the ventrals shields does not I think invalidate the recognition of two distinct "forms" which I still choose to regard as "species" though I expect others will not accord to them so exalted a rank.

Beddom's Tree Snake – *Dipsadomorphus nuchalis* (Beddome).

In my paper published in the Records of the Indian Museum (see footnote to *D. ceylonensis* I recorded a sequence of 16 examples characterised by costals 21 in midbody, ventrals 234 to 251, and subcaudals 90 to 108. Since then I obtained before this year another example with costals 21, ventrals 244, and subcaudals 108. This year my Nilgiri sojourn furnished 42 others with costals 21 (rarely 23, and once 25 in places), ventrals 233 to 252, and subcaudals 95 to 111. I have now therefore seen 59 examples of a "form" characterised by costals 21 (in places more), ventrals 233 to 242 and subcaudals 90 to 111.

Habitat.—This "form" was most common in the Wynaad, but fairly abundant on the slopes of the other parts of the Nilgiri District.

Sexes.—Of 25 sexed, 12 were ♂ and 13 ♀.

Food.—On five occasions frogs were discovered "in gastro" and three of these were species of *Ixalus*. Lizards furnished the meal on nine other occasions, *Calotes versicolor* twice, and *Charasia dorsalis* once. Two mice and the feathers of a bird were found in one stomach, and a single fledgling in another.

Breeding.—No gravid ♀ was included in the total.

Growth.—August and September furnished eight examples from 13 to 15¾ inches in length, July four from 20 to 25¼ inches, July to September twelve from 28 to 41 inches, and seven from 45 to 50½ inches. These seem to indicate the broods of successive years. My largest ♂ was 50¾ inches, the largest ♀ 48¾ inches.

Lepidosis.—As in the previous species I noted the tendency for some shields in the vertebral row to disintegrate. In one specimen the scales would be counted as 23 in places, but here the vertebrals were broken up into the three, and the costal rows remained normal. In another there were 23 rows in the anterior, and middle parts of the body, the vertebral splitting in places to make the count 25. Posteriorly the scale rows are consistently 15.

Dentition.—The maxilla has 14 teeth, followed after a short gap by 2 elongate, grooved, pseudo fangs.

The palatine holds from 6 to 7, the pterygoid 15 to 17, and the mandible 20 to 23.

Forsten's Tree Snake—*Dipsadomorphus forsteni* (Dumeril and Bibron).

Only one specimen and that a small one came to hand. It was captured on Pilloor Estate. This measured 20¾ inches. The costals were 27 anteriorly to well behind midbody, and dropped to 17 two heads length before the anus. The ventrals were 260, and the subcaudals 109.

Dentition.—The maxilla holds 10 to 12 teeth followed after a short gap by 2 elongate, grooved, obliquely-set, pseudo fangs. The palatine has 6 to 7 teeth, the pterygoid 9 to 11, and the mandible 17 to 19.

Perrotet's Whip Snake—*Dryophis perroteti* (Dumeril and Bibron).

An aggregate of 57 specimens were collected, all from altitudes above about 5,000 feet.

Sexes.—Of 54 specimens sexed, 25 were ♂ and 29 ♀.

The keels are rather more pronounced in males.

Food.—Frogs and lizards form their staple diet. Of frogs 15 examples contained species of *Ixalus* (two examples two frogs, and one example three frogs). One other had swallowed a frog too digested to recognise. Of lizards toll was taken of species of *Lygosoma* by six specimens (one containing two). Once the species was definitely *albopunctatus*. A *Gonatodes jerdoni* was recognised in one, and a species of *Calotes* in another.

Breeding.—The season is later than for most other species in these Hills. Altogether I received nine gravid females which I record in tabular form.

Date.	Length of dam in inches.	Nos. of embryos or eggs.	Remarks.
20/6 to 10/7	18	2	Contained one non-fertilised egg and one sac with an embryo 5¼ inches long.
6 to 12/8	18½	4	Contained small eggs ½ inch long.
12 to 24/8	17¾	2	Follicles distinctly enlarged to ⅓ inch.
1 to 6/9	22	6	Eggs ⅝ inch long with contents the consistency of a meally potato.
,,	22⅜	5	Eggs ¾ inch long.
,,	23	10	Sacs ¾ inch long containing minute embryos.
,,	20	5	Eggs with no trace of embryos.
,,	20½	5	Eggs ⅝ inch long.
,,	22	3	Eggs with no trace of embryos.

It will be noticed from this that the majority contained eggs in an early stage of development as late as September. From analogy I judge that the young would not have been born till the end of the year, or the beginning of next.

Growth.—I think it will transpire that the embryos measure 5½ to about 7 inches at birth, judging from the appearance of the foetus 5¼ inches in length. Four specimens varying from 8⅝ to 11½ inches in September seem to indicate birth from October last year to March this year. Twelve examples ranging between 13¾ and 15¾ inches, I take to be last year's production. Females attain a greater length than males. My largest ♂ was 20¾ inches, and no less than eight females exceeded this length, the largest being 23 inches.

Colour.—The verdant-green hue is to be accounted for in exactly the same manner as that of the next species.

Lepidosis —The scale rows are 15 to a point well behind midbody, and reduce to 13 at a point two heads-lengths before the vent. This applies to both sexes. The ventrals in the ♂ were 137 to 142, and in the ♀ 138 to 146. The subcaudals in the ♂ were 71 to 81, and in the ♀ 65 to 75.

Green Whip Snake—*Dryophis mycterizans* (Linne).

Mr. Vernede tells me it is called "kannu pambu" (meaning "eye snake") by his coolies.

The aggregate totalled 82, mostly from the lower slopes. One killed on Liddlesdale shows that stragglers may go up to about 6,000 feet.

Sexes.—Of the 73 examples sexed, 43 were ♂ and 39 ♀.

Food.—Lizards had furnished the meal on six occasions, a *Lygosoma* once, a *Mabuia* once, and *Charasia dorsalis* once. Others were too digested to identify. Frogs had been victimised by five examples, on three occasions a species of *Ixalus* having been taken. One example had eaten an *Ixalus*, and an agamoid lizard. Another had swallowed a good sized snake of the species *Rhinophis sanguineus*. The snake was doubled up in the stomach, and not lying at full length as happens in the case of snakes victimised by *Bungarus* and *Hemibungarus*.

Breeding.—For the number of specimens collected the information derived is meagre. Only four gravid females were included. One killed between the 22nd and 25th of August, measuring 4 feet 9 inches, contained 10 eggs about one inch long with embryos from 2 to 3 inches in length inside. One killed between the 28th of August, and the 1st of September measuring 5 feet 10 inches, contained 5 eggs about one inch long with small fœtuses inside. One killed between the 1st and the 8th of September, measuring 3 feet 11 inches contained 3 embryos. One of these was 14½ and another 12¼ inches long, and the third was very much deformed. A fourth example killed between the 20th and 30th of September, measuring 3 feet 10½ inches, contained 4 eggs about ¾ of an inch in length. The season for the birth of the young is evidently between July and December or perhaps even January. This is borne out by a specimen 18½ inches long, being killed in August, and the fact that one specimen late in September contained very immature eggs.

Growth.—Young of the year were not well represented. Three examples only were acquired, all in August, and these ranged between 15 and 18½ inches. The variation in the length of the young at birth, also that between the sexes, and the long season for birth make it very difficult to follow the broods of successive years. However, 20 males ranging between 39½ and 46¾ inches, and 14 females varying between 41 and 48¾ inches are almost certainly about completing their second year of life, and it is probable that the 8 males between 23½ and 34 inches represent those completing their first year of life.

Females acquire a greater length. Thus my largest ♂ was 51 inches, and I had three ♀ exceeding this, their respective measurements being 56, 57 and 70 inches.

The tail is decidedly longer in the males.

Colours.—I made many observations on the colour, and it is a surprising fact that the very beautiful chlorophyll-green hue is not caused by a green pigment. The only pigment to be derived from the skin is a fairly bright yellow. The scales viewed under a good lens are seen to be studded with minute yellow points. I had frequently noticed that the spirit in which specimens had been preserved, acquired a yellow tinge and the skins became more and more bluish. Having carefully washed six freshly-removed skins with soap and water in my bath, I placed these in water and boiled them. The result was that the skins acquired a bluish tinge, and a decided yellow tinge was imparted to the water.

As I boiled this away the yellow became more pronounced and I had great hopes of obtaining a powder eventually. In this however I was disappointed, as the final stage simply left the tin coated with a thickish varnish of yellow. This I had great difficulty in dissolving again, trying chloroform, ether, and rectified spirit cold, and brought to the boiling point. Finally a 70 per cent. boiling solution of rectified spirit proved successful. The skin is really a light blue, and the minute peppering with yellow pigment produces the green effect. Some specimens are more heavily pigmented than others, and correspondingly more of a yellowish-green. If one examines the scales on the throat one frequently sees patches of a beautiful Cambridge-blue, owing to the usual yellow pigment seen elsewhere happening to be wanting. Again in the overlapped portions of the dorsal scaling especially in the forebody the colour is seen to be Cambridge-blue, the yellow pigment here also being absent. The flank line too if examined will be seen devoid of blue, and is therefore either quite white, or when pigmented a bright, pure yellow.

When the skin is stripped, small white lines from the inside aspect of the skin are seen in echelon, forming chevrons with the apices directed backwards thus, and these marks

are found to correspond with the overlapped Cambridge-blue edging of the costal scales. An uninterrupted well-defined white line is also seen on the inside of the skin corresponding to the outwardly visible flank line. Now it is interesting to note further that the beautiful blue referred to is also not due to a pigment. It is to be accounted for by a peculiarity inherent in the skin itself. This on the inner side is heavily impregnated with black pigment, and the colourless, translucent, epithelium covering it reflects the blue of sunlight from its minute particles, whilst absorbing all the other colours.

Lepidosis.—It is curious that I found that the scale rows which are 15 to well behind midbody, reduce to 11 in males, with one exception. In females however it reduced to 13 only, with the exception of five specimens. The ventrals in the ♂ were 172 to 182, and in the ♀ 170 to 182. The subcaudals in the ♂ were 148 to 170, and in the ♀ 132 to 144.

The Brown Whip Snake—*Dryophis pulverulentus* (Dumeril and Bibron).

This proves to be a much more uncommon species than I had previously supposed, only two specimens being procured.

One ♂ was 54¼ inches long, the tail accounting for 22¼ inches. The ventrals were 191 and the subcaudals also 191. The ♀ example measured 57¼ inches of which the tail accounted for 23 inches. The ventrals were 190, and the subcaudals 181. The tail of a skink probably a *Mabuia* was found in the stomach.

As far as I am aware this has not previously been reported from the Nilgiri Hills.

Dentition.—The maxilla supports anteriorly 5 small teeth, followed by 2 large and subequal teeth fully twice the length of the preceding. After a gap that would take about 3 teeth, there is a series of 5 to 6 quite small teeth succeeded by 2 large, grooved, subequal, pseudo fangs about thrice the length of the immediately preceding array. The palatine has 9 teeth, and the pterygoid 19 to 22. The mandible has anteriorly 5 teeth progressively increasing in length, followed by a gap that would take about 4 teeth, after which there is an array of from 15 to 16 small teeth.

The Golden Tree Snake—*Chrysopelea ornata* (Shaw).

Seven specimens only were received, all of the variety figured in my popular article on this snake. (Vol. xviii, opposite page 228, figures 1 to 4.)

The vermilion vertebral spots were obolescent in some, faint in others, and bright in others in the anterior part of the body especially.

Food.—One had swallowed a lizard of the species *Gonatodes jerdoni* ( ).

Growth.—One measuring 11½ inches was evidently this year's production. Two measuring 25 and 26⅞ inches were obviously last year's progeny. The largest was a ♀ 47½ inches in length.

Lepidosis.—The ventrals ranged between 216 and 228, and the subcaudals from 119 to 140. The last ventral as is usual was bifid like the anal.

SUB-FAMILY ELAPINÆ.

The Common Krait—*Bungarus cœruleus* (Schneider).

Only 5 examples were acquired and all from the Wynaad. It would appear from this that the species does not ascend these Hills to the same level as in the Western Himalayas where I have had specimens up to 5,000 feet.

Sexes.—Four were of the ♀ and one of the ♂ sex.

Food.—All the three young examples had fed on *Typhlops* which appeared to me to be the species *fletcheri.* The largest of these *Typhlops* was 5¾ inches long.

Growth.—One killed in August measuring 12¼ inches was this year's hatchling. Two others 16½ and 17½ inches, I think are probably this year's hatchlings also.

The Cobra—*Naia tripudians* (Merrem).

Twelve examples were acquired. These were all light specimens with a well-defined binocellus on the hood conforming to forma *typica.*

Food.—A small example 16½ inches in length had eaten a young snake of the species *Zaocys mucosus.*

Growth.—Specimens of 14, 14½, 15¾ and 16 inches were, I think, hatched out this year.

The Hamadryad—*Naia bungarus* (Schlegel).

Two young specimens came to hand, both I think just hatched, and being encountered together on the same day (between the 25th and 27th of August) probably of the same brood.

Colour.—They were both as black as an ordinary krait (*Bungarus cœruleus*) with very similar pure white bands numbering in one example 32, and in the other 36 on the body, and 12 and 11 respectively on the tail. The head was black with the tip of the snout white, a white transverse band across the præfrontals, an interrupted, narrow band just behind the eyes from which two white stripes converged backwards where they almost met a similar white oblique stripe on the neck. On the belly plumbeous replaces the black of the dorsum, and this gets darker posteriorly till beneath the tail, the bands are quite as black below as above.

Size.—One measured 20¾, and the other 20¼ inches.

Lepidosis.—The ventrals in the former were 241, and in the latter 239. The subcaudals in the former were 85, the 1st to 13th, 25th, 37th to 40th entire ; in the latter 37, the 1st to 15th, 19th to 22nd, 29th and 30th entire. The costals are, as I have always found them, 19 over the middle of the hoods, two heads-lengths behind the head 17, at midbody 15, and two head-lengths before the anus 15. The vertebral row is slightly enlarged.

I came across one largish specimen while butterfly catching on the ghat road at about 2,500 feet elevation. My attention was arrested by what I took to be a very loud hissing, and as I looked round I saw a large, blackish snake about 20 yards away, through a window in the foliage that allowed me to see it, without my attracting its attention. It was moving extremely slowly up a five foot bank on the cart road, and I must have had a good 30 seconds to observe it. I should judge it at about 9, perhaps 10 feet, and as it dilated its hood very distinctly, in response to the agitated gibberings of a squirrel (*Funambulus striatus*) in the twigs of a lantana bush above it, there can be little doubt about its identity. The noise I took to be a prodigious hissing proved to be the scoldings of a magpie robin (*Copsychus saularis*) that was perched in the lantana thicket. With only a butterfly net at my command I gave the snake a wide berth.

Dentition.—The maxilla supports 3 teeth behind the fangs. The palatine teeth number 7 to 9, the pterygoid 10 to 14, and the mandible 14 to 16.

The Striped Coral Snake—*Hemibungarus nigrescens* (Gunther).

The 58 representatives of this species show that it inhabits a belt between about 3,000 and 7,000 feet elevation. Four came from over 6,500 feet.

Sexes.—Of 39 sexed, 27 were ♂ and 12 ♀.

Disposition.—It appears to be a very quiet, and inoffensive snake. A friend of mine encountered one on the road towards Lamb's Rock (Circa 6,000 feet). It made no attempt to escape but crawled slowly along without showing any alarm. He walked right up to it, and finally killed it. Such a nature would account for the character of its diet, for in every case where it had fed the snake victimised was one of the most inoffensive and slowly moving species.

Food.—It is entirely ophiophagous in habit. A *Plectrurus perroteti* had been swallowed on five occasions, a *Xylophis perroteti* on four others. *Silybura ocellata* had furnished the repast on two occasions, and *Silybura brevis* on one other. A *Melanophidium wynadense* had been victimised once. *Typhlops* provided the meal on three occasions, a specimen of *beddomi* once, and what appeared to be *fletcheri* twice. In every case the snake swallowed was lying at full length within, and in the case of large specimens these extended forwards into the gullet.

Breeding.—No single ♀ had follicles fertilised. Three specimens in the late Mr. Gray's collection were gravid, measuring respectively 25½, 26 and 26¾ inches, and contained 4, 3 and 6 eggs, respectively. It is evidently not prolific. The lengths cited above point to sexual maturity at the end of the second year of life. The eggs were in every case too small to expect an embryo to be visible and none could be discovered.

Growth.—Young of the year were represented in specimens measuring from 9 $\frac{1}{15}$ to 9¾ inches (3) in July, from 8½ to 9¾ (6) in August, and from 9 to 11½ inches (5) in September. A young one in the late Mr. Gray's collection taped 8⅜ inches. A further series of 10 specimens ranging between 17¼ and 23½ inches evidently represents last year's production, and another series of 14 between 30 and 38½ inches appear to be the preceding year's progeny. The season for the appearance of the young is probably from May to August. My largest ♀ was 31¼ inches, and I had six ♂ exceeding this measurement. My largest was 40½ inches, and I believe a ♂. (Ventrals 240 and subcaudals 37).

Colour.—I would place all the examples with Boulenger's variety "B." I noticed that in the young the colour is chestnut (as applied to a horse). The black stripes are well defined and bordered with beaded, white lines.

As it attains maturity the light ground colour darkens, till in adult life the whole dorsum is blackish. The stripes—in all cases five—were still indicated by interrupted white lines for a variable extent anteriorly, but these became obsolescent, or completely lost posteriorly in many specimens. The belly was a most beautiful rose-pink which viewed through a less appears perfectly smoothly diffused. In young specimens the belly was white or faintly pink, and the intensity of this hue appears to increase with age. In some examples the belly was mottled with blackish tones.

Lepidosis.—The ventrals in the ♂ ranged between 230 and 252, and in the ♀ from 230 to 239. The subcaudals in the ♂ were 37 to 44 and in the ♀ 30 to 36.

Dentition.—The maxilla supports from 3 to 4 (usually 3) teeth behind the fangs. The palatine teeth number 8 to 11, the pterygoid 5 to 8, and the mandibular 9 to 10.

Bibron's Coral Snake.—*Callophis bibroni* (Jan.)

A solitary specimen of this very rare species was acquired from the Wynaad and that a young one only $8\frac{3}{8}$ inches in length. The ventrals were 219, and the subcaudals 35. It was flesh coloured with 33 complete black bands on the body and 6 on the tail. These are narrower than the intervals costally, but by an expansion vertebrally about the same breadth. There was a broad, white, parieto-occipital band on the head divided mesially by a black line. The head otherwise was black.

Boulenger in his Catalogue (Vol. III, p. 396) says among other generic features that this genus has no teeth in the maxilla. As a matter of fact he is in error for that remark only applies to the species *macclellandi*. In my skulls of *maculiceps* and *trimaculatus* there are 2 to 3 postmaxillary teeth, and in two *bibroni* that I have examined 1 (dubiously 2).

Family 9 *VIPERIDÆ.*

Sub-Family VIPERINÆ.

Russell's Viper.—*Vipera russelli* (Shaw).

Twenty-eight specimens were brought in, nearly all young. This is probably due to my asking those collecting not to send in large specimens.

Food.—No less than ten young of the year were distended with their prey, a mouse being found in the stomach in every case. In five others packs of hair were found in the stomach of the cloaca.

Growth.—Young of the year were represented by 10 individuals in July, measuring from $9\frac{3}{8}$ to $12\frac{1}{2}$ inches, 7 in August varying from 10 to $12\frac{1}{8}$ inches, and 2 in September measuring $13\frac{1}{4}$ and $13\frac{3}{4}$ inches respectively.

Poisoning.—Mr. Vernede had a cooly woman bitten by a large example judged to be 5 feet in length. In 10 minutes from the casualty she was brought in a comatose state for treatment, and within 15 minutes of the accident was dead. This is a very good example of what frequently occurs. The woman was bitten by a poisonous snake, but did not die of snake poisoning. Death from this toxæmia takes many days, often a week. She died of syncope from fright.

The Saw-scaled Viper.—*Echis carinatus* (Schneider).

Only 5 examples were brought in, all from Pilloor Estate. It is evident that this species which is so common in the plains rarely comes above 3,000 feet. The markings in all were remarkable for their rusty tones dorsally and ventrally.

One had swallowed a *Scolopendrum.*

Sub-Family CROTALINÆ.

Millard's Hump-nosed Viper.—*Ancistrodon millardi* (Wall).

Eleven specimens of this species described by me in this Journal in 1908 (Vol. XVIII, page 792) were sent in, all from Pilloor Estate.

Sexes.—Of 6 sexed, 4 were ♂ and 2 ♀.

Food.—A lizard had been swallowed in two instances, one juvenile specimen of 6¼ inches length having taken a *Charasia dorsalis*. One adult contained a mouse, and in another a wad of hair was protruding from the cloaca.

Growth.—My smallest was a ♂ (?) 6¼ inches long in July. My largest ♂ was 15⅛, and ♀ 15 inches.

Lepidosis.—The head shielding is wonderfully consistent. The frontal is invariably disintegrated with 3 small scale-like parts anteriorly, and one large entire part posteriorly. The boss on the snout is slight, and has few small scales upon it (4 or 5). The 2nd labial does not enter the loreal pit in any specimen. The ventrals in the ♂ were 40 to 43, and in the ♀ 30 to 34.

Dentition.—The maxilla holds 2 fangs. The palatine teeth number 4 (dubiously 3 in one specimen), the pterygoid 13 to 16, and the mandible 16 to 19.

The Horseshoe Pit Viper.—*Lachesis strigata* (Gray).

The total for this species was 48. I think it occurs at an altitude only above 5,000 feet and one specimen obtained at Avalanche was killed at a height estimated at about 7,000 feet.

Sexes.—Of 37 sexed, 17 were ♂, and 20 ♀.

Food.—Those that had recently fed were found to have swallowed mice and frogs. Once a snake had been devoured. Adults seem to favour a murine diet, five having eaten mice, and another contained a mass of hair. One had eaten an *Ixalus*. A half grown example had eaten some species of frog. Two young ones had fed on species of *Ixalus*, and one other 8½ inches long had made a meal of a snake of the species *Plectrurus perroteti*.

Breeding.—No single ♀ showed any enlargement of the ovarian follicles. The season for the appearance of the young judging from its congener *anamallensis* will probably prove to be the early months of the year.

Growth.—Five specimens between 7¼ and 8½ inches long in August and September, I take to be the fruits of last year's mating produced early this year. Adults usually attain a length of from 14 to 16 inches. I received one 18 inches long, one ♀ 18, and two ♀ 19 inches long.

Lepidosis.—The costal rows were always 21 to a point well behind mid-body, and reduced to 17 at a point two heads-lengths before the anus. The ventrals in the ♂ were 137 to 141, and in the ♀ 137 to 142. The subcaudals in the ♂ were 35 to 42, and in the ♀ 32 to 35. In one the 3rd subcaudal was entire.

Dentition.—The maxilla has a pair of fangs. The palatine teeth number 5 or 6, the pterygoid 10, and the mandible 12.

The Green Pit Viper.—*Lachesis graminea* (Shaw).

I acquired 22 of this common species, the majority (17) coming from the Wynaad.

Sexes.—Of those sexed, 7 were ♂ and 6 ♀.

Colour.—With reference to what has been said about the verdant-green colouration of *Dryophis mycterizans* I find that in this species also there is a yellow pigment overlying the blue beneath. Under a lens I can see no minute spots of pigment, but the yellow is evenly laid on like a varnish except where the scales overlap, and here the blue is cærulean. On the last row of scales the yellow is laid on very thickly giving a bright yellow effect, the blue beneath being entirely masked.

Food.—Mice were victimised by six specimens. In the case of a young specimen $9\frac{1}{2}$ inches long, a frog of the genus *Ixalus* had been eaten.

Breeding.—No ♀ showed any sign of enlarged follicles, which makes it probable that the birth of young occurs at much the same season as in the next species.

Growth.—Four examples measuring from $8\frac{1}{2}$ to $9\frac{1}{2}$ inches in August and September were probably born early this year. Five specimens between $15\frac{3}{8}$ and $16\frac{3}{4}$ inches I think represent the young of the preceding year. My largest ♂ was $20\frac{3}{4}$ and my largest ♀ $24\frac{1}{4}$ inches.

Lepidosis.—The ventrals ranged between 148 and 165, and the subcaudals from 45 to 63. In one the 2nd to 6th, 30th, 33rd to 35th, 37th to 39th, 41st to 48th, 57th and 60th were entire.

Dentition.—The maxilla holds a pair of fangs. The palatine teeth number 3 to 5, the pterygoid 10 to 14, and the mandible 10 to 13.

The Anamallay Pit Viper.—*Lachesis anamallensis* (Gunther).

This species yielded no less than 193 specimens, and it would appear to be the commonest snake in the Wynaad, Mr. Wapshare alone sending me in 143. It favours a belt between about 3,000 and 5,000 feet, and evidently does not come much above the latter limit.

Sexes.—Of 62 sexed, 34 proved to be ♂ and 28 ♀.

Food.—A large number had recently fed and were enormously distended in many cases. Rats and mice appeal to the gastronomic tastes of adults, small frogs and lizards to that of the juvenile ranks At least 4 had eaten rats, and 27 mice. Packs of hair were found in the stomach, intestines, or cloacæ of many others. A large lizard *Calotes versicolor* was removed from one adult. Young between 8 and 14 inches had taken small frogs on six occasions, a *Lygosoma* once, and another small lizard on another occasion. The species obviously plays a considerable part in keeping down the numbers of murine vermin.

Breeding.—I received 5 gravid specimens, and in each case the cyœsis was in a very early stage. One $24\frac{3}{4}$ inches in length between the 25th July and 3rd of August contained 8 small, spherical, and enlarged follicles about $\frac{3}{8}$ of an inch in diameter. Another between the same dates measuring $19\frac{1}{2}$ inches, showed 3 follicles in about the same stage. One between the 9th and 16th of September contained 8, and another 6 enlarged, spherical follicles about $\frac{3}{4}$ of an inch in diameter. A fifth measuring $28\frac{1}{4}$ inches between the 20th and 30th of September, showed 16 follicles enlarged to about $\frac{3}{4}$ of an inch in diameter. The lengths of two of these were not recorded, but the series shows what I have on previous occasions drawn attention to, *viz.*, that with snakes as a general rule the older the snake the more prolific its tendencies. It is not likely that any of these would have produced their broods before about February or March next year.

The season for the birth of the young is between February and August. The gravid ♀ $19\frac{1}{2}$ inches long points to sexual maturity at the end of the second year of life.

Growth.—A specimen $6\frac{3}{4}$ inches long in August was obviously but recently born. One $9\frac{1}{2}$ inches long killed between the 25th of July and 3rd of August, and two specimens $8\frac{3}{4}$ and $9\frac{3}{8}$ inches long in August, I reckon, were born in February and March this year, assuming that the growth in this species is as I have found it in so many other species, where the young just about double their length in the first year of life. Six examples in July ranging between 12 and 13 inches must have been born about last July. Similarly 8 specimens in August between 12 and 14½ inches in July and August last year. Two more measuring 13¼ and 15 inches in September would also point to birth in or before August last year.

My largest ♂ was 25 inches. No less than ten ♀ equalled or exceeded this measurement, my largest being 28¼, 29¼, 29¼, 29½ and 33 inches.

Parasites.—One specimen had an unusually large nematode worm in the intestine measuring 3½ inches.

Colour.—The variation in the light tones is extreme. Every shade of dirty yellow tinged with green, and different intensities of green being seen in different individuals. Again the darker tones vary from a light brown through every shade to black, and the degree of variegation also varies enormously. Many specimens might have been taken for a dead stick, and some showed a remarkable resemblance to a dead stick covered with lichen.

Lepidosis.—I only examined this critically in a limited number of specimens, but I found 19 scale rows in four of these. The ventrals in the ♂ were 143 to 154, and in the ♀ 137 to 148. The subcaudals were 52 to 61 in the ♂ and 49 to 54 in the ♀. In one the 6th to 9th were entire.

Dentition.—The maxilla carries a pair of fangs. The palatine teeth number 4 to 6, the pterygoid 15 to 19, and the mandibular 13 to 16.

I think it will add to the interest of this paper to give a list of all the snakes that are known to inhabit the Nilgiris, and Wynaad, including with them all the species known to inhabit the South Indian Plains, since most of the latter are to be met with in the Hills up to 2,000 and 3,000 feet, and some even up to 6,000 and 7,000 feet.

I have made the list in the form of a key which will, I think, facilitate the identification of the species to be met with.

I have eliminated from the list for reasons cited below species which have been incorrectly reported from the area under discussion.

In a previous number of this Journal (Vol. XVIII, p. 782) I showed good reason to doubt many of the localities attached to specimens collected by the late Colonel Beddome, and presented by him to the British and Indian Museums, and the collection now under review substantiates the doubts previously expressed.

In the note referred to I showed that no less than eight species which are well known from Bengal, Burma, and Tenasserim are recorded from the Hills of S. India on the sole authority of Beddome. These are (1) *Tropidonotus parallelus*, (2) *T. subminiatus*, (3) *T. himalayanus*, (4) *Lycodon jara*, (5) *Simotes splendidus*, (6) *S. Octolineatus*, (7) *Dendrelaphis caudolineatus* and (8) *Bungarus fasciatus*. To this formidable list should also be added (9) *Dendrophis pictus*. As was to be expected no specimen of any of these species were brought in this year.

Simotes splendidus.—This species described by Gunther in 1875 from a single specimen presented to the British Museum by Beddome, and labelled "Wynaad" in his own handwriting remained the only known specimen for many years. In 1899 Colonel Evans and I recorded it (dubiously owing to the previously reported locality) from Sagaing, Upper Burma (Vol. XIII, p. 537 of this Journal). Colonel Evans later (Vol. XVI, p. 362) reported two more from Burma, one from the Ruby Mines District and the other from Yamethin District. I threw doubts on the locality of the type specimen (Vol. XVIII, p. 782). Later I recorded another from Kyaukse, Upper Burma. (Record of Ind. Mus, Vol. II, p. 105). Since then I have examined two more specimens from Burma, precise locality not recorded. In the meantime no other example has been discovered in the Wynaad.

Simotes beddomi.—The remarks made under the last-named species lead me to think that the types of this species also collected by Beddome, and presented to the British Museum, and labelled "Wynaad" have the locality incorrectly recorded. These specimens appeared to me typical of *S. theobaldi* a snake I was very familiar with in Burma. I examined the types of *S. beddomi* beside specimens of *S. theobaldi*, and could discover no difference (see Vol. XXIII, p. 170 of the Journal).

The evidence of inaccuracy in Beddome's records is so convincing that one is justified in doubting all his other S. Indian records of locality that have not up to the present time been confirmed by other observers. Accordingly in my key to the species I attach an asterisk to all those whose locality rests on the sole authority of Beddome.

Zaocys dhumnades.—A specimen of this Chinese snake is in the British Museum labelled "Deccan" on the authority of the late Colonel Sykes. Boulenger's Catalogue, Vol. I, p. 376. This is obviously another flagrant error in habitat.

Cerberus rhynchops.—The British Museum has a specimen of this snake labelled "Nilgiris" on the authority of Theobald (Boulenger's Catalogue, Vol. III, p. 17). This is without doubt another error, for this snake is a denizen of tidal rivers only.

KEY TO FAMILIES.

Ventrals not enlarged.—Anal divided into 3 or 4. Eye immobile beneath shields. Pupil round .. .. .. *Typhlopidæ.*

Ventrals enlarged but not twice last costal.—Anal divided into 2; twice breadth of ventrals. Eye immobile, and in one shield (except *Platyplectrurus*). Pupil round .. *Uropeltidæ.*

Ventrals 2 to 2½ times breadth of last costal row.—Anal divided into 3; as broad as ventrals. Eye mobile, and surrounded by many shields. Pupil vertical. Costal rows more than 40 .. .. *Boidæ.*

Ventrals more than 3 times last costal row.—Anal entire or divided; as broad as ventrals. Eye surrounded by many shields. Pupil variable. Costal rows less than 40. Two pairs of sublinguals .. .. *Colubridæ.*

Ventrals more than 3 times last costal row.—Anal entire; as broad as ventrals. Eye surrounded by many shields. Pupil vertical. Costal rows less than 40. One pair of sublinguals .. .. *Viperidæ.*

Key to Typhlopidæ.

Serial number.	Number of costal rows round body.	Snout in profile rounded or beaked.	Suture above nostril.			Suture below nostril.		Diameter of body to total length.	Name of species.
			None.	Partial	Complete.	To præocular.	To 2nd labial.		
1	18	round.	yes	..	..	..	yes	$\frac{1}{58}$ — $\frac{1}{94}$	Typhlops porrectus.
2	18	,,	..	..	yes	..	yes	$\frac{1}{30}$ — $\frac{1}{36}$	,, *beddomi.*
3	20	,,	..	..	yes	yes	..	$\frac{1}{28}$ — $\frac{1}{30}$	,, limbricki.
4	20	,,	..	..	yes	yes	..	$\frac{1}{34}$ — $\frac{1}{49}$	,, braminus.
5	20	,,	..	..	yes	..	yes	$\frac{1}{40}$ — $\frac{1}{45}$	(N), (W) Typhlops *fletcheri.*
6	20	,,	..	yes	..	..	yes	$\frac{1}{53}$ — $\frac{1}{52}$	(N) ,, *thurstoni.*
7	28 to 34	beaked.	..	..	yes	..	yes	$\frac{1}{40}$ — $\frac{1}{60}$	,, acutus.

Key to Uropeltidæ.

Serial number.	Costal tows.			No. of shields touching rostral.	Supraocular present or absent.	One pair of sub-linguals or none.	Eye in single shield or surrounded by many.	Snout.			Ventrals.	Subcaudals.	Name of species.
	2 heads lengths behind head.	Midbody.	2 heads lengths before anus.					Acutely pointed.	Obtusely pointed.	Rounded.			
8	13	15	13	4	0	+	1	..	..	yes	175 to 185	10 to 15	(W) *Melanophidium wynadense.*
9	13	15	13	4	0	+	1	..	..	yes	183 — 198	15 — 18	,, *punctatum.*
10	13	15	15	4	0	+	1	..	..	yes	188 — 200	15 — 17	* (W) ,, *bilineatum.*
11	13—15	15	15	4	+	0	1	..	..	yes	152 — 165	7 — 12	*Plectrurus perroteti.*
12	15 ?	15	15	4	0	0	1	..	..	yes	171 — 175	10 — 12	*(N) ,, *guentheri.*
13	15 ?	15	15	4	0	0	1	..	..	yes	164 — 177	8 — 12	*(W) ,, *aureus.*
14	17	17	17	4	+	0	many	..	..	yes	120 — 150	5 — 9	* (W) *Platyplectrurus sanguineus.*
11	17	17	17	4	0	0	1	..	..	yes	120 — 146	8 — 12	*Silybura brevis.*
16	17	17	17	4	0	0	1	yes	..	...	144 — 172	6 — 10	,, *ellioti.*
17	17 (19)	17(19)	17 (19)	4	0	0	1	..	yes	..	193 — 231	6 — 11	,, *ocellata.*
18	19	15	15	6	0	0	1	yes	..	..	182 — 214	5 — 10	*Rhinophis sanguineus.*

Key to Boidæ.

Serial number.	Costal rows in midbody.	Ventrals.	Subcaudals.	Name of species.
19	40 to 49	162 to 136	17 to 24	Eryx conicus-
20	56 — 65	192 — 210	25 — 36	,, johni.
21	61 — 75	242 — 265	60 — 72	Python molurus.

Key to Colubridæ.

Serial number.	Costal rows.			Vertebral row enlarged.	Loreals.	Labials.		Pupil.	Ventrals.	Anal.	Subcaudals.	Name ot specie
	2 heads-lengths behind head.	Midbody.	2 heads-lengths before anus.			Touching eye.	Touching anterior temporals.					
						rd.-th.	ta. th.					
22	13	13	13	No.	0	34	45	Round.	130 to 147	1	17 to 39	*Xylophis perrotetti.*
23	13	13	13	,,	1	34	56	Vertical.	200 ,, 243	2	65 ,, 88	Dryocalamus nympha.
24	13	13	13	,,	0	34	567	Round.	218 ,, 252	2	32 ,, 44	*Hemibungarus nigrescens.*
25	13	13	13	,,	0	34	56	,,	228 ,, 266	2	24 ,, 35	Callophis trimaculatus.
26	13	13	13	,,	0	34	56	,,	222 ,, 226	1	25 ,, 39	Callophis *bibroni.*
27	15	15	11 or 9	Yes.	1	45 or 56	789	,,	163 ,, 200	2	113 ,, 146	Dendrelaphis tristis.
28	15	15	11 or 9	,,	1	456	78	,,	174 ,, 188	2	117 ,, 124	*Dendrophis grandoculis.*
29	15	15	13 or 11	Slightly.	0	45	67	Horizontal.	135 ,, 147	2	68 ,, 84	*Dryophis perrotetti*
30	15	15	13 or 11	,,	0	$\frac{4}{4}$5	67	,,	169 ,, 203	2	136 ,, 174	,, *mycterizans.*
31	15	15	13 or 11	,,	0	$\frac{4}{4}$5	56	,,	180 ,, 212	2	146 ,, 207	*Dryophis pulverulentus.*
32	15	15	15	No.	1	34	56	Round.	158 ,, 218	2	34 ,, 36	Oligodon subgriseus.
33	15	15	15	,,	0	34	56	,,	164 ,, 173	2	25 ,, 29	,, *brevicauda*
34	15	15	15	Yes.	0	34	56	,,	200 ,, 218	1	38 ,, 50	Bungarus cæruleus.
35	15	15	15	No.	0	34	56	,,	127 ,, 163	2	64 ,, 76	*Ablabes calamaria.*
36	17	15	15	,,	0	34	567	,,	215 ,, 262	1	80 ,, 117	Naia bungarus.
37	17	17	14 to 12	,,	3 to 5	$\frac{4}{4}$5	56 or 567	,,	180 ,, 213	2	95 ,, 146	Zaocys mucosus.
38	17	17	13	,,	1	456 or 56	78 or 678	,,	200 ,, 238	2	100 ,, 144	Chrysopelea ornata
39	17	17 or 15	15	,,	1 or 0	34	56	,,	138 ,, 162	2	28 ,, 36	*Oligodon venustus*
40	17	17 or 15	15	,,	0	34	56	,,	129 ,, 142	2	23 ,, 36	,, *affinis.*
41	17	17	15	,,	1	345	67	Vertical.	178 ,, 224	2	56 ,, 80	Lycodon aulicus.
42	17	17	15	,,	1	345	67	,,	175 ,, 202	1	56 ,, 76	,, *travancoricus.*
43	17	17	15	,,	1	345	67	,,	144 ,, 189	2	34 ,, 66	Lycodon striatust.
44	17	17	15	,,	2	345	67	,,	189 ,, 202	1	64 ,, 74	,, *anamallensis.*
45	17	17	15	,,	1	34	56	Round.	167 ,, 202	2	41 ,, 59	Simotes arnensis.
46	17	17	15	,,	1	34 or 4	6 or 7	Vertical.	145 ,, 151	1	30 ,, 34	Gerardia prevostiana.
47	17	17	17	,,	0 or 1	345 or 456	78	Round.	151 ,, 225	2	47 ,, 76	*Polyodontophis subpunctatus.*
48	17	17	17	,,	1	3	5	,,	206 ,, 215	2	68 ,, 73	*Rhabdops olivaceus.*
49	19	19	15	Yes.	1	345	67	Vertical.	209 to 240	1	94 to 111	*Dipsadomorphus ceylonensis.*
50	19	19	17	No.	1	56 345	78 67	Round.	125 ,, 152	2	70 ,, 93	Tropidonotus piscator.
51	19	19	17	,,	1	456 34	78 56	,,	131 ,, 152	2	62 ,, 77	,, *beddomi.*
52	19	19	17	,,	1	345 456	67 78	,,	120 ,, 161	2	46 ,, 89	,, stolatus.
53	19	19	17	,,	1	345	67	,,	134 ,, 145	2	80 ,, 92	,, *monticola*
54	19	19	17	,,	1	45	678	,,	129 ,, 157	2	55 ,, 85	Helicops schistosus.
55	21	21	15	Yes.	1	345	67	Vertical.	207 ,, 256	1	76 ,, 95	Dipsadomorphus trigonatus.
56	21	21	15	,,	1	345	67	,,	248 ,, 266	1	113 ,, 129	Dipsadomorphus nuchalis.
57	21	23	17	No.	1	$\frac{3}{3}$ 45 $\frac{4}{4}$ 56	567 698	Round.	197 ,, 225	2	73 ,, 92	Zamenis fasciolatus.
58	23	23	15	,,	0	34	56	,,	170 ,, 200	1	52 ,, 65	Naia tripudians.
59	23 25	23 25	19 or 17 20 or 19	,,	1	0	..	Vertical.	133 ,, 156	2	49 ,, 72	Cerberus rhynchops
60	21 23 25	23 25 27	17 19 21	,,	1	34 45	67 78	Round.	144 ,, 163	2	34 ,, 50	*Macropisthodon plumbicolor.*
61	21 23 25	23 25 27	17 19 21	,,	1	56 67	.. ..	,,	200 ,, 265	1	74 ,, 96	*Coluber helena.*
62	25	27	17	Yes.	1	345 450	..	Vertical.	254 ,, 207	1	103 ,, 131	Dipsadomorphus forsteni.
63	ab	out	100	No	many	0	0	,,	....	many	..	Chersydrus granulatus.

Key to Viperidæ.

Serial number.	Costal rows.			Ventrals.	Subcaudals.	Subcaudals divided or entire.	Name of species.
	2 heads-lengths behind head.	Midbody.	2 heads-lengths before anus.				
64	17	17	17	136 to 152	30 to 44	Divided.	*Ancistrodon millardi.*
65	21	21	15	167 ,, 175	55 ,, 75	,,	*Lachesis graminea.*
66	21	21	15	138 ,, 158	48 ,, 63	,,	,, *anamallenete.*
67	21	21 (23)	17 or 15	134 ,, 145	31 ,, 40	,,	,, *strigata.*
68	27 to 29	29 to 31	23 to 21	154 ,, 180	42 ,, 64	,,	Vipera russelli.
69	23 to 29	29 to 31	27 to 21	122 ,, 192	21 ,, 48	Entire.	Echis carinatus.

FOOTNOTE TO KEY.

* Implies that the locality rests solely on Beddome's authority and therefore calls for confirmation.

W. Implies has only been recorded from the Wynaad.

N. Implies has only been recorded from the Nilgiris.

No. 9. *Melanophidium punctatum* so far as I know has not been recorded from the Nilgiris or Wynaad, but is to be expected, as specimens from the Hills south of this area have been recorded, and I in this Journal (Vol. XXIII, p. 377) mentioned one found at Tolwadi in the Hills North of this area.

No. 47. *Polyodontophis subpunctatus* has not been actually recorded from the Wynaad or the Nilgiris but is to be expected as it is known from the Hills to the north, and the south of this area.

Nos. 59, 63 and 46, *viz.*, *Cerberus rhynchops*, *Cherydrus granulatus*, and *Gerardia prevostiana* are all snakes peculiar to estuaries or tidal rivers, and would not be found near these Hills. They are incorporated in the key for the sake of completeness with regard to the snakes known from the South Indian Plains. The names in italics are mountain forms, those in Roman characters and denizens of the Plains, all of which are to be met with on the lower elevations of the Hills (excepting Nos. 59, 63, and 46).

SOME BIRDS OF LUDHIANA DISTRICT, PUNJAB.

BY

H. Whistler, F.Z.S., M.B.O.U.

It so chanced last year (1917) that on return from England I was posted to Ludhiana District and remained there for roughly four and-a-half months from the 20th June to the 9th October. During my spare time in that period I collected a fair number of birds and made a considerable amount of notes, but the time was too short and the time of year rather unsatisfactory for gaining anything like a complete knowledge of the birds of the district. Several interesting birds were however obtained and a desire to get them on record has induced me to write this short note, to which for the sake of completeness I have added the names of all species observed, so as to form a nucleus for a future complete list of the birds of the district. All notes unless otherwise stated refer to the neighbourhood of the town of Ludhiana past which runs an old channel of the Sutlej River known as the Budhan Nala; this channel is clear cut and well defined running between grassy meadows, with occasional reed beds along its banks; it was one of my happiest hunting grounds, most of the country round Ludhiana being merely a mixture of cultivation and sandy plain with coarse Sarkana grass.

Ludhiana is a town and district of considerable importance situated on the main line of the N.-W. Railway betwen Ambala and Amritsar; its north-westerly boundary is the River Sutlej over which the Railway line and Great Trunk road cross about 6 miles from Ludhiana at a place called Ladhowal.

The serial numbers and names of the species refer to those used by Blanford and dates in the four volumes of Birds "Fauna of India Series."

1. The Raven—*Corvus corax*. L.

7. The Indian House-Crow—*Corvus splendens*, Vicell.

16. The Indian Tree-Pie—*Dendrocitta rufa* (Scop.).

104. The Striated Babbler—*Argya earlii* (Blyth.).

Some Babblers seen in the grass jungle at Ladhowal were probably of this species.

105. The Common Babbler—*Argya caudata* (Dum.).

107. The Large Grey Babbler—*Argya malcolmi* (Sykes).

Common and doubtless resident at Ludhiana, Jagraon, and Khanna.

110. The Jungle Babbler—*Crateropus canorus* (L.).

139. The Yellow-eyed Babbler—*Pyctorhis sinensis* (Gm.).

Met with occasionally in July and August; an empty nest was found on July 11th but it was apparently deserted; a pair with a brood of newly fledged young were seen on 6th August.

243. The Common Iora, *Ægithina tiphia* (L.)

On the 10th August I saw a small bird in some Kikurs on the Railway bund at Ladhowal, at the edge of the Sutlej River and shot it as being of a kind new to me. On recovery it proved to be a female of this species and had probably bred in the vicinity ; the ovary and oviduct shewed signs of recent activity, and there was the remains of an incubation patch. There was no trace of moult. This species has only previously been recorded in the Punjab from Gurdaspur and Hoshiapur districts where it appears to be not uncommon (*vide* A. J. Currie, Jour. B. N. H. S. XXIV, 602).

278. The Madras Red-vented Bulbul—*Molpastes hæmorrhous* (Gm.).

327. The Black Drongo—*Dicrurus ater* (Herm.).

366. Blyth's Reed Warbler—*Acrocephalus dumetorum* (Blyth.).

Passed through in fair numbers on migration in September and the first week of October.

374. The Indian Tailor-bird—*Orthotomus sutorius* (Forst.).

381. The Rufous Fantail-warbler—*Cisticola cursitans* (Frankl.).

Most abundant during June, July, August, and September, but towards the end of the latter month there were perhaps signs of a decrease, and the species is very probably for the most part a summer visitor only. Many nests were found in June and July.

During the breeding season the male soars in the air in a most erratic fashion, rising and falling in jerks, but keeping roughly to an area of which the centre is the nest site towards which he falls very quickly at intervals, as if intending to settle ; just, however, as he nears the ground he shoots up into the air again and resumes his soaring jerks. All the time he utters a creaking note which rises to its climax as each ærial jerk reaches its highest point, coinciding with it. Any small bird that approaches the nest is fiercely attacked.

While feeding the young the parent approaches the nest in somewhat similar fashion, flying well up in the air, but not rising to the height of the male's display ; as it comes it utters a note which is softer and more level in tones, than the song described above, but the whole approach rather resembles the above display and to the uninitiated might be mistaken for it.

When disturbed the young in the nest utter a menacing hissing note.

384. The Rufous-fronted Wren-warbler—*Franklinia buchanani* (Blyth.)

386. The Long-tailed Grass-warbler—*Laticilla burnesi* (Blyth.).

On July 1st 2 or 3 of these warblers were seen in a stretch of grass and tamarisk in the Railway embankments of the Sutlej bridge at Ladhowal, and another was seen in the same place on 2nd September.

392. The Bristled Grass-warbler—*Chætornis locustelloides* (Blyth.).

On 1st July I shot a male which was calling cheerfully perched on the top of a tall sprig of tamarisk which rose above the level of the grass and tamarisk jungle mentioned under the last species. From the condition of the organs it was evidently a breeding bird.

394. Sykes' Tree Warbler—*Hypolais rama* (Sykes.)

A few were observed on migration in September.

402. The Indian Lesser Whitethroat—*Sylvia affinis* (Blyth.).

Observed in small numbers in September and October, being first noted at Khanna on 12th September.

418. Hume's Willow Warbler—*Phylloscopus numii* (Brooks).

Observed commonly in September and the first week of October.

462. The Streaked Wren-warbler—*Prinia lepida*, Blyth.

464. The Ashy Wren-warbler—*Prinia socialis* (Sykes).

Occasionally met with in the fields, both at Ludhiana and Khanna, but does not seem to be very numerous.

466. The Indian Wren-warbler—*Prinia inornata*, Sykes.

Very common and probably resident. I found a nest with 5 hard set eggs on 1st September, built about 5 feet from the ground in a clump of Pampas grass. It was of the usual deep purse shape, built of fine shreads of pampas grass with a slight lining of vegetable cotton ; this lining was not placed in the bottom of the cup, where the eggs would rest on it, but about an inch higher forming as it were a sort of dado.

469. The Indian Grey Shrike—*Lanius lahtora*, Sykes.

473. The Bay-backed Shrike—*Lanius vittatus*. Val.

476. The Rufous-backed Shrike—*Lanius erythronotus* (Vig.).

This species was not observed until 6th September on which day I saw three ; after this I observed single birds on the 7th, 17th and 21st September and two on 2nd October.

488. The Common Wood Shrike—*Tephrodornis pondicerianus* (Gmel).

500. The Small Minivet—*Pericrocotus peregrinus* (L.).

Observed both at Ludhiana and Khanna.

501. The White-bellied Minivet—*Pericrocotus erythropygius* (Jerd.).

Although unfortunately no specimen was procured I saw two parties of Minivets on 27th June near the Civil Lines Park which appeared to be different to the ordinary species, and to have the lower parts white. It is quite possible that they belonged to this species which has been recorded from the neighbouring district of Ambala.

518. The Indian Oriole—*Oriolus kundoo*, Sykes.

A summer visitor and very numerous, being specially abundant about Ladhowal. The majority probably left in the second half of September but I saw an adult male on 5th October.

528. The Rosy Pastor—*Pastor roseus* (L.).

A small but well marked passage of these birds was observed from the 18th to the 31st of July, during which period I observed almost every evening one or more flocks passing in a south-easterly direction, always on the same line.

A single straggler was seen with some Mynahs on September 29th.

544. The Blackheaded Mynah—*Temenuchus pagodarum* (Gm.).

This handsome Mynah was observed not uncommonly at Ludhiana during my stay from the middle of June until the 23rd September after which I did not meet any ; a nest hole at which birds had been seen on 30th June was opened on the 14th August and then found to contain a fully feathered young bird which I reared successfully. Further south at Khanna I found these Mynahs very abundant driving a visit from the 11th to the 13th of September.

The above nestling started to sing in the first week of September, and has ever since been a most energetic chorister; its own song which in the beginning was low and pleasant has been rather spoilt by the imitation and inclusion of the song of the Common Mynah. In November it underwent a complete moult, including the wing and tail feathers. The iris was at first blue but later assumed the grey colour of the adult.

549. The Common Mynah—*Acridotheres tristis* (L.).

551. The Bank Mynah—*Acridotheres ginginianus* (Lath.).

Met with in small numbers in August, September, and October.

555. The Pied Mynah—*Sturnopastor contra* (L.).

One was seen in Ludhiana on 5th July and there were some frequenting the neighbourhood of the Budhan Nala near the railway in the first week in October; during my visit to Khanna from the 11th to the 13th of September the species was common there, being found both singly and in flocks. One was seen near Chappar on 2nd October.

588. The Brown Flycatcher—*Alseonax latirostris* (Raffl.).

I obtained a male of this species in the garden of the rest-house at Khanna on the 12th September; it was there hawking in the shady lower boughs of some large trees, and I mistook it for *Muscicapa grisola*. The bird was an adult and was a little fat. There was no sign of moult, and the organs were small.

This appears to be the first record for the Punjab of this well known and widely spread species.

598. The Paradise Flycatcher—*Terpsiphoni paradisi* (L.).

Single examples on migration were observed on September the 18th, 26th and 29th and on October 7th.

604. The White-browed Fantail Flycatcher—*Rhipidura albifrontata* Frankl.

608. The Common Pied Bush-chat—*Pratincola caprata* (L.).

Common during my stay in the district.

610. The Indian Bush-chat—*Pratincola maura* (Pall.).

A winter visitor only, first observed on 14th September.

618. The Pied Chat—*Saxicola picata* Blyth.

A male was observed on 3rd October.

619. The White-capped Chat—*Saxicola capistrata*, Gld.

A female shot on 6th September was the first wheatear observed on the autumn migration; a male was seen at Khanna on 12th September.

625. The Isabelline Chat—*Saxicola isabellina* Cretz.

One was seen on a ploughed field on 8th October.

629. The Brown Rock Chat—*Cercomela fusca* (Blyth).

Observed at Ludhiana in June and October, and at Jagraon in July.

644. The Indian Redstart—*Ruticilla rufiventris* (Vieill.).

This common winter visitor was first seen on 25th September but it was still scarce when I left Ludhiana on 9th October.

647. The Red-spotted Blue-throat—*Cyanecula suecica* (L.).

Observed as follows: 1 on 7th September, and 2 or 3 on 29th September; 1 on 2nd October and 1 on 4th October.

661. The Brown-backed Indian Robin—*Thamnobia cambaiensis* (Lath.).

663. The Magpie Robin—*Copsychus saularis* (L.).

A male was seen on the 8th of October.

734. The White-throated Munia—*Uroloncha malabarica* (L.).

735. The Spotted Munia—*Uroloncha punctulata* (L.).

On 13th July I saw in company with a flock of the last species in the Park a couple of "spice-birds;" they were somewhat larger than the white-throated Munias, and as far as I could see had a black head, the upper parts chestnut, with 'scaled' whitish underparts. Unless they had escaped from captivity it is possible that they were of this species, which is otherwise unknown to me, but might be expected to occur occasionally in the Southern Punjab.

738. The Red Munia—*Sporæginthus amandava* (L.).

These little Munias were very abundant about the embankments of the Sutlej bridge at Ladhowal in July, occurring in large flocks in the flooded grass and tamarisk jungle.

A few were noted in September.

761. The Common Rose Finch—*Carpodocus erythrinus* (Pall.).

A party on migration were seen feeding in a Peepul tree in the Resthouse compound at Khanna on 12th September.

775. The Yellow-throated Sparrow—*Gymnorhis flavicollis* (Frankl.).

Common but perhaps a summer visitor only.

776. The House Sparrow—*Passer domesticus* (L.).

777. The Rufous-backed Sparrow—*Passer pyrrhonotus*, Blyth.

I have already recorded in the Journal the meeting of a flock of these Sparrows near Ludhiana on 19th February 1910.

Sp ? Sand Martin—*Cotile* Sp. ?

A few Sand Martins were observed about in July, August and September, but in October there was a most noticeable passage, great numbers frequenting the neighbourhood of the Railway bridge over the Budhan Nala. Unfortunately I omitted to collect any specimens so the exact species remains a matter of doubt.

813. The Swallow—*Hirundo rustica*, L.

A single straggler was seen on 24th July; one was seen on September 1st and perhaps others during the month. In October several parties were seen.

818. The Wire-tailed Swallow—*Hirundo smithii*, Leach.

Common throughout my stay in the district.

Sp ? Striated Swallow—*Hirundo* Sp ?

A flight of Striated swallows were seen at Jagraon on the 9th July and a single bird at Ludhiana on 29th July.

A fair number were also seen in September and October, but the exact species was not identified.

826. The White Wagtail—*Motacilla alba*, L.

829. The Masked Wagtail—*Motacilla personata*, Gld.

833. The Grey-headed Wagtail—*Motacilla borealis*, Sundev.

835. The Indian Blue-headed Wagtail—*Motacilla beema*, Sykes.

847. The Indian Pipit—*Anthus rufulus*, Vieill.

On my arrival in June this Pipit was found to be very common on the grass meadows of the Budhan Nala where it was usually met with in pairs, feeding on the stretches of more closely cropped turf. The majority appeared to have finished nesting but the breeding display of the male was frequently seen both in June and July; it was not observed after the end of July; after that there was a slight tendency to gather in flocks but the species remained common in August and September, though I did not observe it after 25th September.

In the breeding display the male rises in the air in an ascending succession of dipping curves, uttering all the time a jangling rather bunting like note; arrived at the highest point in the air he then falls again to earth in an abrupt curve with stiff partly extended wings. This Pipit perches freely on bushes and tufts of grass.

I took four fresh eggs from a nest on 29th June. This nest was very well concealed amongst the grass and coarse stumps in the top of a tussock of cropped sarkana grass; the nest which was domed with a deep cup was too loosely constructed for removal; it was composed of dry shreds and blades of coarse grass, with a slight lining of smaller scraps—almost chaff—and a few fine horse hairs. When disturbed the female fluttered out and along the ground as if wounded.

861. The Indian Skylark—*Alauda gulgula*, Frankl.

This skylark was also common on the grassy meadows of the Budhan Nala on my arrival in June; a few males were still in song but the majority of birds seen were in small parties of 4 or 5 which frequented patches of longish grass and lay often very close; these parties seemed to be chiefly composed of immature birds and were perhaps family parties.

The male when singing mounts to a great height, almost vertically, with the head to the wind and the wings fanning rapidly; having attained its pitch it remains there for a long time, keeping roughly in the same place; it starts to descend in the same fashion as it rose, but when it is some 25 yards and so from the ground the song ceases and the bird falls rapidly with the wings held stiffly open. The song is well sustained but monotornus, and of the usual skylark type; imitations of the notes of other birds such as *Sarcogrammus indicus* and *Totanus ochropus* are also introduced.

About August the species seemed to move away from the neighbourhood of the nala and I did not notice it elsewhere.

867. The Indus Sandlark—*Alaudula adamsi* (Hume).

Is found very abundantly in the bed of the River Sutlej where it breeds.

869. The Singing Bush-lark—*Mirafra cantillans*, Jerd.

This strange little lark was found to be very common in the neighbourhood of the Budhan Nala in June and July; it did not frequent the grass meadows along the margin so much as the sandy plains covered with coarse tufts of grass which extend on both sides of the nala. The males soar and sing somewhat after the manner of *Alauda gulgula*, but do not go so high and once up at their pitch move in wider circles; the descent is also more precipitate from the start. They are determined mimics and one was heard combining in his song the discontented chattering call of *Falco jugger* and the shrill call of *Coccystes jacobinus*. It is I think this lark which is so often heard singing by night in the darkness.

The flight of this species is curiously stiff, with the wings jerking rather than beating and appearing not to rise above the level of the back, while the tail is partly spread.

A strange performance is sometimes indulged in when the male flies backwards and forwards along a beat of some 12 yards and so, keeping at the same height above the ground,and singing a curious little harsh song of some 2 or 3 monotonous notes.

867. The Crested Lark—*Galerida cristata*, L.

879. The Ashy-crowned Finch-lark—*Pyrrhulauda grisea* (Scop.).

Met with throughout my stay, but particularly common in September.

895. The Purple Sunbird—*Aracthnecthra asiatica* (Lath.).

This common summer visitor was still numerous as late as the 25th September, and one or two were seen about until my departure from the district.

921. The Thick-billed Flower-Pecker—*Piprisoma squalidum* (Burt.).

I saw a single specimen of this bird in a Peepul tree in the rest-house garden at Khanna on 12th September; so it is extremely probable that I was right in my identification of a small bird seen in Civil Lines at Ludhiana on 13th August and attributed to this species.

972. The Yellow-fronted Pied Woodpecker—*Loipicus Mahrattensis* (Lath.).

986. The Golden-backed Woodpecker—*Brachypternus aurantius* (L.).

1019. The Crimson-breasted Barbet—*Xantholœma hæmatocephala* (P. L. S. Müll.).

1022. The Indian Roller—*Coracias indica*, L.

1026. The Litte Green Bee-eater—*Merops viridis*, L.

This abundant summer visitor was still common when I left the district on October 9th.

1027. The Blue-tailed Bee-eater—*Merops philipppinus*, L.

In June and July a small colony of these Bee-eaters were observed haunting a particular locality by the Budhan Nala; in August the species became more abundant and more widley spread although the original colony of June and July had left its quarters; I put this change down to the moving and packing of the species after the completion of breeding; they continued common during September, but had started to decrease in number when I left the district on October 9th.

1033. The Indian Pied Kingfisher—*Ceryle varia*, Strickl.

1035. The Common Kingfisher—*Alcedo ispida*, L.

Observed as follows: single birds near the Budhan Nala on September 5th and October 2nd, one near Ladhowal on September 2nd and 2 near Ladhowal on September 15th.

1044. The White-breasted Kingfisher—*Halcyon smyrnensis* (L.).

1062. The Grey Hornbill—*Lophoceros birostries* (Scop.).

Although I only saw the Grey Hornbill on two occasions (in July) at Ludhiana, it was common towards Khanna when I went there in September.

1066-7. Races of Hoopœ—*Upupa epops*, L.

Hoopœs were common throughout my stay in the district, but unfortunately I did not obtain sufficient specimens to speak with certainty about the race represented.

1073. The Common Indian Swift—*Cypselus affinis*, Gray and Hardw.

These swifts which had been abundant since my arrival on 20th June began to decrease in numbers towards the end of September; there were however some still about when I left the district on October 9th.

107–. Sp.? Spinetail Swift—*Chætura*, Sp.?

On 7th July at Jagraon two very large swifts seen flying, for the most part high, in company with a number of *Cypselus affinis* certainly belonged to some species of spine-tail.

1090. Franklin's Nightjar—*Caprimulgus monticola*, Frankl.

I met with a flight of 8 or 10 of these Nightjars in a small patch of grass jungle on 31st July ; three specimens obtained were all in heavy moult. Two more were seen near the Budhan Nala on 9th August, and on the 10th August a few were found on the Railway embankment at Ladhowal. One of these shot was in moult, but exhibited what appeared to be the remains of an incubation patch. Two more were seen at Ladhowal on 15th September.

1104. The Cuckoo—*Cuculus canorus*, L.

This cuckoo was observed about the embankments at Ladhowal on passage in August and September ; I saw one thereon 5th August, several on 10th August (on one occasion 3 being in sight at the same time), and one on 15th September ; 4 were seen there by a friend on 28th September.

1109. The Common Hawk-cuckoo—*Hierococcyx varius* (Vahl.).

In the 'Fauna of India' it is stated that this Cuckoo does not occur in the Punjab ; I have however elsewhere (Jour. B. N H. S. Vol. xxvi, 177) recorded it as a common summer visitor in the neighbouring district of Ambala, and it is interesting to record this further extension of its known range.

On arrival at Ludhiana on 20th June I found that the 'Brain-fever' bird's well known call was to be heard daily, both early and late, and sometimes by moonlight as well; this continued throughout July and the first half of August. During the latter half of the month I was away, but a certain number lingered on into September, and I last heard the call before dawn on September 19th.

1118. The Pied Crested Cuckoo—*Coccystes jacobinus* (Bodd.).

I did not come across this Cuckoo in June but first observed it on July 1st; it was very common and noisy throughout July and August, but about the middle of September it began to get scarce again, it was only heard once or twice during the second half of the month, and two were heard on 3rd October. It is doubtless a monsoon visitor only.

1120. The Indian Koel—*Eudynamis honorata* (L.).

This Cuckoo remained abundant until the end of September but in October I only met with two, both on the 6th of the month; from the 16th to the 30th of September a couple of fledged nestings were haunting the trees in my compound, carefully fed and tended by a pair of *Corvus splendens*.

1130. The Common Coucal—*Centropus sinensis* (Steph.).

1135. The Large Indian Paroquet—*Palæornis nepalensis*, Hodgs.

1138. The Rose-ringed Paroquet—*Palæornis torquatus* (Bodd.).

1139. The Western Blossom-headed Paroquet—*Palæornis cyanocephalus* (L.).

This pretty little Paroquet was found to be not uncommon during my stay in the district.

1152. The Barn Owl—*Strix flammea*, L.

One was heard and seen about the Tehsil garden at Jagraon during my visit there from 7th to 9th July.

1161. The Mottled Wood Owl—*Syrnium ocellatum*, Less.

On 19th July I saw a large Owl in a heavily wooded part of the Park which was apparently of this species.

1169. The Dusky Eagle-Owl—*Bubo coromandus* (Lath.).

— sp ? Scops Owl—*Scops* sp. ?

Some species of Scops Owl was heard calling at night in August and September.

1180. The Spotted Owlet—*Athene brama* (Temm.).

1189. The Osprey—*Pandion haliaëtus* (L.).

On 20th September I came upon a fine Osprey eating something on the summit of a Kikur tree near the Budhan Nala which was then in flood; I could not see what the booty was, but below on the ground was an indeterminate mass of entrails, apparently of a large frog. When disturbed the bird flew away across the floods, occasionally approaching the surface of the water and ploughing it with his outstreched talons for 5 or 6 yards at a stretch.

Two more Ospreys were reported to me on 28th September, and on 4th October I saw in the distance what was almost certainly a bird of the same species.

1191. The King Vulture—*Otogyps calvus* (Scop.).

1196. The Indian White-backed Vulture—*Pseudogyps bengalensis* (Gm.).

1198. The Egyptian Vulture—*Neophron percnopterus* (L.).

1203. The Indian Tawny Eagle—*Aquila vindhiana*, Frankl.

Not uncommon during my stay in the district; a nest with a single egg, apparently unfertile, was found near the Budhan Nala on 29th June, which is an unusully late date for this species to be breeding.

1207. Bonelli's Eagle—*Hieraëtus fasciatus* (Vieill.).

1220. The White-eyed Buzzard-Eagle—*Butastur teesa* (Frankl.).

1223. Pallas' Fishing Eagle—*Haliætus leucoryphus* (Pall).

1228. The Brahminy Kite—*Haliaëtur indus* (Bodd.).

The Brahminy Kite was first seen on 6th July, when a single individual was catching flying ants in my compound; after this the species became common and many were seen, both adults and immature birds, in August and September; there were still some about when I left the district on 9th October.

The meadows and floods of the Budhan Nala were the favourite haunt of the species.

1229. The Common Pariah Kite—*Milvus govinda*, Sykes.

1233. The Pale Harrier—*Circus macrurus* (S. G. Gmel.).

1237. The March Harrier—*Circus æruginosus* (L.).

A very ragged individual of this species was occasionally seen about the Budhan Nala in June and July. The return migration of this species, however, did not commence properly until September, although a single individual was also seen on 30th August. There were a fair number about in September.

1244. The Shikra—*Astur badius* (Gmel.).

1249. The crested Honey-Buzzard—*Pernis cristatus* (Cuv.).

A nest containing two well marked eggs was found in the railway bunds at Ladhowal on 3rd July; the female sat closely, but the eggs appeared to be unfertile. The nest was situated in a large Shisham tree, one of a clump of trees on a bund surrounded by reeds and water.

A Honey Buzzard was seen at Ludhiana on 10th August, and perhaps another on 25th September.

1257. The Lugger Falcon—*Falco jugger*, Gray.

1265. The Kestrel—*Tinninculus alaudarius* (Gmel.).

This winter visitor was first observed on the 19th September, and another was seen on the 29th of the month.

1272. The Southern Green Pigeon—*Crocopus chlorogaster* (Blyth.).

Observed occasionally both at Ludhiana in July, August and September, and at Khanna in September.

1292. The Indian Blue Rock Dove—*Columba intermedia,* Strickl.

1295. The Eastern Stock Dove—*Columba eversmanni,* Bonap.

One was shot on 23rd September; it was feeding in company with a number of *Columba intermedia.*

1307. The Spotted Dove—*Turtur suratensis* (Gm.).

A Spotted Dove was observed in my compound on 26th September; this was the only one seen in the district.

1309. The Little Brown Dove—*Turtur cambaiensis* (Gm.).

1310. The Indian Ring Dove—*Turtur risovies* (L.).

1311. The Red Turtle Dove—*Œnopopelia tranquebarica* (Herm.).

1321. The Common Sandgrouse—*Pteroclurus exustus* (Temm.).

1324. The Common Peafowl—*Pavo cristatus,* L.

The Peafowl is very abundant about Ludhiana and Jagroaon and of course a resident.

I found two nests containing 4 eggs apiece in my garden on 8th August and 26th September; both were mere scratches in the ground, the former in a pumpkin bed, the latter in a tangle of grass and herbage in a waste plot.

1356. The Rain Quail—*Coturnix coromandelica* (Gm.).

Occasionally heard calling in June, July and the beginning of August. On 16th July I flushed a pair near the Nala and shot the female, who while dying laid a fully formed soft white egg, so the species certainly breeds here.

1372. The Black Partridge—*Francolinus vulgaris,* Steph.

1375. The Grey Partridge—*Francolinus pondicerianus* (Gm.).

1383. The Little Button-Quail—*Turnix dussumieri* (Temm.).

Found in fair numbers during my stay in the district in the near neighbourhood of Ludhiana.

1384. The Indian Button-Quail—*Turnix tanki,* Blyth.

I shot an adult male of this species near Ludhiana on 11th July, which is the only specimen that I have hitherto obtained in the Punjab.

1393. The Eastern Baillon's Crake—*Porzana pusilla* (Pall.).

A number of these small Crakes must have passed through on migration in the first week of September, for I flushed two on September 1st and four on September 6th, from flooded herbage by the edge of the Budhan Nala. Three specimens were shot and preserved.

1402. The Waterhen—*Gallinula chloropus* (L.).

Met with on two occasions in the railway bunds at Ladhowal in September, and on two occasions by the Budhan Nala in September.

1403. The Watercock—*Gallicrex cinerea* (Gm.).

About 5 miles from Ludhiana along the Grand Trunk Road is the station of Ladhowal close to the Railway bridge over the Sutlej river. The erection of the bridge and the confining of the river at this point have rendered necessary the building of a series of embankments and wide borrow pits, which holding water at most times of the year are covered with luxuriant vegetation. In particular the borrow pits have become huge reed beds which are the favourite haunt of many aquatic birds. In one of these reed beds on July 24th I found a nest with 3 eggs which was new to me; from the difficult situation of the nest which could only be approached with a boat and much disturbance I had great difficulty in identifying the owner of the nest, and it was only on 5th August that I managed to surprise her at home. She flew off across an open stretch of water with the blundering flight of a Moorhen, and I shot her, to find that I had secured *Gallicrix cinerea*; by this date the 6 eggs of the clutch were rather incubated. The nest was a thickish pad, flat and rather insecure, of green reeds, with a slight canopy of reeds bent ever it, placed about 15 ins. above the surface of the water in a thick tuft of coarse grass and reeds, growing at the end of a submerged 'bund.' The nest was well concealed and I had to part the foliage to get my hand in; the bird must have entered by climbing the stems around. A curious looking bird flushed in a neighbouring patch of reeds on the 24th and 28th of July was doubtless the male of the nest. I can find no previous record of the species for the Punjab.

1414. The Great Indian Bustard—*Eupodotis edwardsi* (Gray.).

In the Bengal 'Sporting Magazine' for 1857 there is said to be an account of the riding down of one of these Bustards by a party of officers near Ludhiana, but I have not had an opportunity of verifying the reference. The species is not likely to be found in the district now.

1419. The Great Stone Plover—*Esacus recurvirostris* (Cuv.).

1422. The Indian Courser—*Cursorius coromandelicus* (Gm.).

Two Coursers seen from the train near Ludhiana (on the Jagraon line) on 6th July appeared to be of this species.

1425. The Large Indian Pratincole—*Glareola orientalis*, Leach.

In Stray Feathers, Vol. II, p. 465, I find this note and reproduce it here for facility of reference :—

"Sir,

I see in your contributions to the Ornithology of India, Stray Feathers, Vol. II, p. 285, you say that you have never heard of the occurrence of *Glareola orientalis* or large Swallow-Plover in the Punjab, so I trouble you with these few lines to say that I shot a specimen on the 19th November 1871 on a bank in a pool about a mile from Ludhiana, Punjab. It was a young bird, I suppose, having lighter colored tips to some of the Feathers on the back of neck and back. Its length was 9 inches, tail 3 inches, legs dark brownish purple. I regret I did not stuff it, but made a drawing of it. I have since lost the drawing, but I feel certain it was the bird described by Dr. Jerdon. It is the only one I have ever seen up here."—F. Field.

1427. The Little Indian Pratincole—*Glareola lactea* (Cmm.).

This Pratincole breeds on the Sutlej River between Phillaur and Ludhiana in large colonies in April and May, and I found many eggs when stationed at Phillaur in 1910. It is probably a summer visitor only.

This year in July I saw many flights of Pratincoles both at Ladhowal and in the neighbourhood of the Budhan Nala; they were occasionally met with on the Budhan Nala both in September and as late as 4th October.

1429. The Pheasant-tailed Jacana—*Hydrophasianus chirurgus* (Scop.).

This handsome bird was observed in small numbers about the pools at Ladhowal in July, August and September, and they were evidently there for the purpose of breeding as I found a nest with 4 slightly incubated eggs on 1st August. The nest was on one of the open stretches of water, but in a corner sheltered by the angle of a reed bed: it was built on the soft submerged weeds which filled the water, and was a mass of soft weeds, roughly circular and flat, about an inch above the surface of the water. The bird left the nest at my approach, and I found that the weeds composing it were wet and absolutely *hot* to the touch. The eggs were lying any how on the nest, in no sort of order.

A party of 4 of these Jacanas were seen on the Budhan Nala on 31st July.

1430. The Red wattled Lapwing—*Sarcogrammus indicus* (Bodd.).

1433. The Yellow-wattled Lapwing—*Sarciophorus malabaricus* (Bodd).

On 10th April 1910, I shot a pair of these Plovers in the riverain area of the River Sutlej, but on the Jullundur side of the River near Phillaur; although this was actually outside the area of the Ludhiana District, I take this opportunity of recording the occurrence of this Plover in the Punjab where it appears to be very rare.

1447. The Little Ringed Plover—*Ægialitis dubia* (Scop.).

1454. The Curlew—*Numenius arquata* (L.).

A party of Curlews were seen near the Budhan Nala on the 12th and 14th of September.

1460. The Common Sandpiper—*Totanus hypoleucus* (L.)

Single individuals were seen on 13th August, 17th September, and 7th October.

1461. The Wood Sandpiper—*Totanus glareola* (Gm.).

With the exception of a single doubtful record on 11th August, I did not see any Wood Sandpipers until 7th September, on which date about 30 and 40 were observed about the Budhan Nala; the rush continued throughout the month and attained its greatest height during the first week of October; for instance, on 2nd October I saw about 70 or 80 of these birds in one big flight on the Budhan Nala.

1462. The Green Sandpiper—*Totanus ochropus* (L.)

Several were seen in July and August, and by September, the species had become fairly common.

1464. The Redshank—*Totanus calidris* (L.).

The Redshank was not identified with certainty before 7th October.

1466. The Greenshank—*Totanus glottis* (L.).

One was seen on 25th July, and one or two in August, and a few more in September: by October they were fairly common.

1484. The Full Snipe—*Gallinago cœlestis* (Fronzel.).

1487. The Jack Snipe—*Gallinago gallinula* (L.).

First observed on 5th October.

1488. The Painted Snipe—*Rostratula capensis* (L.)

On 17th September I saw a wader feeding in the open on a flooded patch of ploughed field and at first thought it was a green Sandpiper; but as I approached it squatted and allowed me to come quite close when it rose and revealed a female Painted Snipe, which I shot; about 50 yards away I found 3 more on a patch of flooded fallow ground covered with a sparse crop of short grass with a few tufts of Sarkana grass; these I saw running rapidly across the open to the tufts of grass by which they squatted. I flushed them but did not fire at them.

However on my return some time later I crossed the same fallow field and saw one squatting and watching me about 15 inches from a tuft of grass. As I went towards it to my astonishment two others got up from the same patch, and of these I secured a male. This ground was a couple of hundred yards from the bank of the Budhan Nala which had recently been flooded by the heavy rains and turned into a sheet of water. It is probable, therefore, that these Painted Snipe were flooded out and so driven to such an unusual feeding ground. They very possibly breed in the vicinity as the ovary of the female shot contained eggs.

The species was not observed again until October when one was seen on 3rd October, and three on the 5th of the month. These were flushed from flooded herbage near the sides of the Budhan Nala.

1496. The Whiskered Tern—*Hydrochelidon hybrida* (Pall.).

A party of 5 Whiskered Terns was seen passing up the Budhan Nala on 25th June, and 2 or 3 immature birds were fishing on the floods by the Nala on 14th September.

1503. The Indian River Tern—*Sterna seena,* Sykes.

Observed commonly throughout my stay.

This species breeds in colonies on the sandbanks of the River Sutlej in April and May.

1504. The Blackbellied Tern—*Sterna melanogaster,* Temm.

Curiously enough the only individuals of this species that I observed were a couple at Ladhowal on October 7th, yet I had been on the look out for it.

It breeds on the sandbanks of [Sutlej in April and May, but is less common than the last species.

1510. The Little Tern—*Sterna minuta,* L.

I found a small colony of this species breeding on a sandbank of the Sutlej near the Railway bridge in May 1910.

1517. The Indian Skimmer—*Rhychops albicollis,* Swains.

Single birds were observed on June 28th and July 28th. The species breeds fairly commonly on the sandbanks of the River Sutlej in April and May, and I found several nests when stationed at Phillaur in 1910.

152-. Sp. ? Pelican—*Pelecanus,* Sp. ?

Four or five Pelicans of some species were seen in the distance on 7th October; they were sitting on a sandbank of the River Sutlej about half a mile above the Railway bridge.

1528. The Little Cormorant—*Phalacrocorax javanicus* (Horsf.).

Found commonly at Ladhowal, and occasionally visiting the Budhan Nala, in July, August, September, and October.

1529. The Indian Darter.—*Plotus melanogaster* (Penn.).

Observed about the embankments at Ladhowal as follows: two on 3rd July, several on 24th July, and one on 5th August.

1542. The Black Ibis—*Inocotis papillosus* (Temm.)

A flock of Black Ibis was seen on 25th September, and three birds on 29th September.

1552. The Painted Stark—*Pseudotantalus leucocephalus* (Penn.).

Observed on the Sutlej near Ladhowal as follows: one on 3rd July, two on 2nd September, and one on 7th October.

1554. The Eastern Purple Heron—*Ardea manillensis* (Sharpe.).

Single birds were seen at Ladhowal on 3rd July, and by the Budhan Nala on 14th July and 3rd October.

1555. The Common Heron—*Ardea cinerea*, L.

Observed fairly commonly throughout my stay in the district.

A great number were seen about the sandbanks of the river on 2nd September, and these were perhaps a migrating flock.

1559. The Large Egret—*Herodias alba* (L.).

One was seen on 4th October.

1561. The Little Egret—*Herodia garzetta* (L.).

1562. The Cattle Egret—*Bubulcus coromandus* (Bodd.).

It is exceedingly difficult to tell the Egrets apart except under the most favourable circumstances, as when seen flying at some distance all look uniformly alike and white.

Egrets, representing doubtless both the above species, were seen throughout my stay in the district, and became particularly abundant in September, when large flocks appeared; *Bubulcus coromandus* was clearly identified on different dates throughout my stay.

1565. The Pond Heron—*Ardeola grayi* (Sykes.).

1567. The Little Green Heron—*Butorides javanica* (Horsf.).

Specimens were obtained at Ladhowal on 15th and 30th September.

1568. The Night Heron—*Nycticorax griseus* (L.).

Observed in small numbers thoughout my stay in the District.

1571. The Yellow Bittern—*Ardetta sinensis* (Gm.).

A fair number of these little Bitterns were seen in the reed beds at Ladhowal on various dates between 3rd July and 15th September; they seemed to keep entirely to the reed beds and never come into the open, hence it was very difficult to observe them or obtain specimens. They are probably nocturnal feeders and may emerge more after dark, as occasionally towards dusk one might be seen winging its noiseless flight over the reed beds without having been flushed by the party. They doubtless breed here, but the thickness of the weeds and reeds, which render rowing, a matter of great difficulty, and the depth of the water which prevents poling in many places, prevented my finding any nests, unless a nest with a single egg found on 5th August belonged to this species. It was however destroyed by some thing before I had identified the owner.

1572. The Chestnut Bittern—*Ardetta cinnomomea* (Gm.).

A male was shot from the big reed bed on 3rd July, and at the spot where it rose I found a nest with one fresh egg which was apparently its property. The nest was a mere pad of wet vegetable matter, resting in Marsh grass, about 15 inches above the surface of the water, in a small bush growing amongst the reeds.

1591. The Cotton-Teal—*Nettopus coromandus* (Gm.).

A pair were seen at Ladhowal on 28th July, and 5 near the same place on 5th August; a female was given to me on September 9th which had been shot that day at Ladhowal. This is the first locality in the Punjab where I have personally met with the species.

1602. The Shoveller—*Spatula clypeata* (L.).

First observed on 7th October.

1617. The Indian Little Grebe—*Podicipes albipennis* (Sharpe.).

On October 5th I found a small party of young Grebes, the size of Thrushes and in the striped down plumage, near their nest which was amongst a few reeds in a flooded borrow pit by the railway line.

REDUCTION OF *EUPHORBIA ROTHIANA*, SPRENGEL, OF THE INDIAN FLORAS.

BY

L. J. SEDGWICK, F.L.S., I.C.S.

It has always been a problem whether or not *E. Rothiana*, Spreng., of the Indian Floras, includes plants referable to more than one species. Wight in his Icones while assigning that name to his specimens collected on the western mountains expressed a doubt as to its correctness, and referred also to the plant described by Heyne in Roth's Nov. Pl. Spec. 230 s. n. *E. læta.* which he held to be a rather rare variety. Boissier in DeCandolle's Prodromus, ten years later, described separately *E. Rothiana*, Spreng., and *E. oreophila*, Miq. Hooker reunited these two species under the former name, holding that the characters by which Boissier had distinguished *E. oreophila*, Miq., did not hold good, "the organs to which they refer being extremely variable."

From personal observation, however, I am convinced that these are two totally distinct species, one of the mountains, and the other of the plains. The former may be either a perennial or a fast-growing annual; the latter is certainly an annual, and is a cold-weather associate of winter crops, being extremely abundant in the Dharwar District, both on the black-soil and among winter crops in the ricefields, but not on stony or gravelly kharif lands.

Very elaborate descriptions only tend to confuse, and while obscuring the salient features often result in errors creeping in through attention to the peculiarities of one or a few individuals. I therefore give the main distinguishing characters only.

I. E. læta, *Heyne in Roth. Nov. Pl. Spec. 230 (1821).*

A *weak*, glabrous, succulent, erect annual ± *1 ft. high, entirely green.* Stem with a few adventitious branches from the axils of the alternate stem-leaves; terminating in a *constant whorl of three leaves.* Branches above the crown always *three.* Subsequent branching dichotomous. Stem-leaves alternate, sessile, flaccid, spreading, narrowly and *exactly linear*, $\pm 2\frac{1}{2} \times \frac{1}{5}$ in.; *suddenly rounded at the base.* Crown-leaves linear-lanceolate $\pm 2 \times \frac{1}{3}$ in. Leaves subtending the dichotomous branchlets ovate-triangular, sub-trilobed, $\pm \frac{3}{4}$ in., and as broad as long, *connate at the base* below the rounded auricles, with strong midrib and very numerous radiating basal nerves. Involucres solitary, glabrous without and glabrate within; *glands with more than 2 short projecting points.* Capsule glabrous, deeply 3-lobed; seeds smooth, from white to lead-coloured, with a very large white, fleshy arillode.

SYNONYMS.—*E. Rothiana*, Spreng. Syst. Veg. III 796 (1826). Boiss. in DC. Prodr., 15. part II, p. 156. Dalz. and Gibs. Bomb. Fl. p. 226 (in part). Hooker Fl. B. I. V. p. 263 (in part). Cooke, Fl. Bomb. II. p. 564 (in part). *E. segetalis*, Grah. Cat. 179 (probably; not of Willd.). It will be seen that Heyne's name has five years' priority over Sprengel's.

DISTRIBUTION.—An annual weed of cultivation on black soil fields and rice fields sown with winter crops. Bombay Carnatic, and probably over a wider range. Flrs. Jan.-Mar.

2. E. oreophila, *Miq. Analect. Bot. III. 17. ex Boiss. in DC. Prodr. V. 15. Pt. II. p. 156.*

A *strong*, erect, glabrous herb, ± *2 ft. high.* Stem *sub-woody*, often *tinged with red*, ending in a crown-whorl of *4 or more* leaves. Branches above the crown *4 or more:* secondary branching dichotomous. Stem-leaves alternate. Sessile, ascending, *lanceolate or oblanceolate,* ± 3 × $\frac{3}{4}$ in., *gradually tapering to the base.* Crown-leaves as the stem-leaves, but broader. Leaves subtending the branchlets as in the last sp. *but not connate at base.* Involucres as in the last; *glands with two long, decurved horn-like points.* Capsules and seed more or less as the last.

SYNONYMS.—*E. glanca,* Roxb. Fl. Ind. II. 473 (not of Willd.). *E. Rothiana,* Wt. Ic. (not of Spreng.) *E. segetalis,* Wt. No. 7691, in herb. DC. ex Boiss. loc. cit. *E. Rothiana,* Dalz. and Gibs. Bomb. Fl. p. 226 (in part). Hooker, Fl. B. I. V. p, 263 (in part). Cooke, Fl. Bomb. II. p. 564 (in part). Fyson, Hill-tops Fl. p. 360.

DISTRIBUTION.—Summit of the Western Ghats, and South Indian mountains, very common in grasslands and forest clearings. Flrs. winter-spring Wight (l.c.) says—" A very common alpine plant, found on nearly all the " higher hills that I have visited. I have specimens from Mahableshwar and " Ceylon, and from numerous intermediate stations." Boissier (l.c.) says— " In montibus Indiæ meridionalis, malabaria." Perhaps also in the Himalayas (*E. divergens,* Klotsch., referred by Boissier to *E. oreophila* and by Hooker to his *E. Rothiana*).

VARIETIES.—(1) Boissier gives " *Var. pubescens,* foliis et capsulæ pedicellis pubescentibus. In territorio Cannara." Hooker retains this variety, but describes it as " branchlets and leaves more or less pubescent." It is also clear that the locality is not Canara but Mercara in Coorg.

(2) Boissier also gives a *Var. Wightiana.* This is Wight's type in Ic. 1864. (*E. Rothiana*). But it seems to be only a luxuriant example.

I base my reduction of Hooker's *E. Rothiana* into the two species above-described on field observation. I have seen *E. oreophila* at Kotagiri in the Nilgiris in 1915 and 1916 and at Mahableshwar in 1918. And I have seen *E. læta* in numerous places in the Dharwar District during the last three winters. The differences between them in habit, etc., are constant. Especially in the case of *E. læta* I must have seen thousands of plants, and have repeatedly watched in vain for any divergence from the exact number of three crown-leaves, and for any lignification or reddening of the stem.

I have to thank Father Blatter for kindly obtaining and sending me the descriptions of the earlier authors to enable me to clear up the synonymy. There are still a few other authorities quoted in the F. B. I., but they are of less importance.

A LIST OF BIRDS FOUND IN THE SIMLA HILLS, 1908-1918.

BY

A. E. JONES.

It has often occurred to me that this list might be of some interest to those who know these hills, but fear it cannot in any way pretend to be exhaustive when such a bird as the Rufous-chinned Laughing-Thrush (*Ianthocincla rufigularis*) is omitted.

Only those birds observed and identified by my friend, the late P. T. L. Dodsworth, from whose M. S. notes many of these records are taken, and myself are included.

Some of the species, though resident, are wonderfully local, while many of the migrants' occurrences are so sporadic that years often lapse without a single specimen being seen, where in other years the same species may be common. Again, many of the records are only accidental visitors and might not occur again for years.

Dodsworth worked the lower hills and valleys, including a three month's trip (January, February and March) in 1913, while I have devoted my spare time to the higher elevations. Our investigations have extended from Kalka on the South to Suket on the North-west and from Bilaspur on the West to Narkanda on the North-east. The elevations explored were approximately from 2,000 ft. up to 10,000 ft.

I take this opportunity of thanking Col. P. S. M. Burlton, Superintendent of Simla Hill States, for his kindness in granting me the privilege of visiting certain parts in this district, without which many of the species now included would not have appeared, and my many friends who have accompanied and helped me on many a hard day's fag.

The nomenclature is that adopted by Oates and Blanford in the "Fauna of India" volumes, and the serial numbers are those of the species in that work.

4. The Jungle-Crow—*Corvus macrorhynchus*, Wagl.

Common resident. Lays end of March to 1st week in May.

7. The Indian House-Crow—*Corvus splendens*, Viell.

Dodsworth and I once saw a single specimen at "Annandale," Simla. Common about Solon. Elevation 4,000 feet.

12. The Red-billed Blue Magpie—*Urocissa occipitalis*, Blyth.

Common in the lower valleys. Frequents the cultivated areas where it breeds. Lays end of April and May. Eggs three to six in number.

13. The Yellow-billed Blue Magpie—*Urocissa flavirostris*, Blyth.

Never observed nearer than Jungi in Mandi State, across the Sutlej. There it appeared to be fairly common at 8,000 ft.

16. The Indian Tree-pie—*Dendrocitta rufa*, Scop.

Common in the lower hills up to 4,000 ft.

18. The Himalayan Tree-pie—*Dendrocitta himalayensis*, Blyth.

Fairly common near cultivation with plenty of dense forest in the vicinity. Lays end of May to middle June. Eggs three or four in number.

24. The Black-throated Jay—*Garrulus lanceolatus*, Vigors.

Common. Breeds indifferently in dense forest or in the vicinity of villages. Lays towards the end of April and throughout May, occasionally in June.

26. The Himalayan Jay—*Garrulus bispecularis*, Vigors.

In the cold weather wanders far and wide but during the breeding season extremely local. At no season does it appear to wander far from the forest. Eggs, of which a good series has been taken, are easily distinguished from *G. lanceolatus*. The nest too is very characteristic, being made of moderate sized sticks and green moss, lined with roots—a firm, compact structure, very different from the nest of the Black-throated Jay. Few nests exhibit any attempts at concealment. From records of eleven nests I find three eggs to be the normal clutch, only twice have I found four.

27. The Himalayan Nutcracker—*Nucifraga hemispila*, Vigors.

As Hume says, "Common about the fir-clad hills just North of Simla". As far as I know the egg has probably not previously been taken in India (Mr. E. C. Stuart Baker has them from Tibet, I believe). A nest I found on the 10th March 1917 containing two young about five days and an addled egg was placed 22 ft. from the ground in a Deodar tree. It was supported by two horizontal branches where they sprang from the main stem. In appearance it resembled a Jay's, but the exterior had, besides the twigs, a certain amount of lichen and dry Oak (*Q. dilatata*) leaves incorporated in it. Lined with dry grass, moss, lichen and hair. It measured externally 8 inches wide by 4 inches deep. Inside breadth 4 inches by 2¼ inches deep.

The young were clothed in white down. The egg is a broad oval. The ground colour is a very pale greenish grey and the markings, which are most numerous at the large end, consist of irregular blotches, some larger and some smaller, of umber brown with a few underlying freckles of pale inky purple.

It measures 1·42 inch long by 1·07 inch wide.

The tree, in which the nest was, stands on a steep hill-side facing East and the surrounding forest, consisting of Deodar, Pine, Oak and Holly, is fairly dense though there is no undergrowth. Elevation 7,500 ft.

31. The Indian Grey Tit—*Parus atriceps*, Horsf.

Common up to about 6,000 ft. In the cold weather descends to the lower valleys and plains. Probably double brooded. Nests found April to July.

34. The Green-backed Tit—*Parus monticola*, Vigors.

Common at all elevations from 6,500 ft. upwards.

35. The Red-headed Tit—*Ægithaliscus erythrocephalus*, Vigors.

Common resident, single brooded. Nests March to beginning of May, though I think these late nests are probably second attempts. One nest I found was lined with feathers of the Imperial Sand-Grouse (*P. arenarius*)!

38. The White-throated Tit—*Ægithaliscus niveigularis*, Gould.
A specimen I obtained on 4th June 1917 was identified by Mr. N. B. Kinnear as pertaining to this species.

42. The Yellow-cheeked Tit—*Machlolophus xanthogenys*, Vigors.
Common up to 7,000 ft. Wonderfully capricious in its choice of habitat. In a large forest I know, which in every respect appears suitable to its economy, it is entirely absent. Breeds April to June and is, I think, double brooded. Eggs usually four in number.

44. The Crested Black Tit--*Lophophanes melanolophus*, Vigors.
Common from about 6,000 ft. upwards. Pine and Fir forests are its principal habitat. Breeds end of March to June.

47. The Simla Black Tit—*Lophophanes rufinuchulis*, Blyth.
Only observed beyond Narkanda from 9,000 ft. upwards where it was apparently not uncommon.

49. The Brown Crested Tit—*Lophophanes dichrous*, Hodgs.
I found this peculiar little bird fairly common in the Pine forest between Narkanda and Baghi. Elevation 10,000 ft.

76. The White-throated Laughing-Thrush—*Garrulax albigularis*, Gould.
Not uncommon, but local. Breeds from 6,500 ft. to 7,500 ft. in April and May.

82. The Red-headed Laughing-Thrush—*Trochalopterum erythrocephalum*, Vigors.
Widely distributed in the cold weather. Never found far from dense cover. Nests up to 8,500 ft. and probably higher. May, June and July. Eggs two, rarely three.

90. The Eastern Variegated Laughing-Thrush—*Trochalopterum variegatum*, Vigors.
Another species which wanders considerably in winter but its nesting haunts are above 7,500 ft. up to at least 8,800 ft. Eggs appear to be invariably three but, of course, may rarely be more or less in number. A noisy bird.

99. The Himalayan Streaked Laughing-Thrush—*Trochalopterum lineatum*, Vigors.
As Hume remarks "one of the commonest birds about Simla." Lays from end of March to August. Eggs usually 3 or 4. Frequently victimised by *Coccyses jacobinus*.

101. The Striated Laughing-Thrush—*Grammotoptila striata*, Vigors.
Usually seen only in pairs. Mostly observed between 7,000 and 8,800 ft. A female shot June 11th would have laid in a few days.

105. The Common Babbler—*Argya caudata*, Dumeril.
Dodsworth observed this species at 3,000 ft. in the cold weather near Kalka.

110. The Jungle Babbler—*Crateropus canorus*, Linn.
Common about cultivation up to 5,000 ft. The Pied Crested Cuckoo often places her eggs in the nest of this species.

129. The Rusty-cheeked Scimitar-Babbler—*Pomatorhinus erythrogenys*, Vigors.
Not uncommon about the outskirts of forests where there is abundance of undergrowth. An early breeder. All nests found in April, though Dodsworth found one containing young in June. Breeds up to 7,000 ft. at least.

174. The Red-billed Babbler—*Stachyrhidopsis pyrrhops*, Hodgson.
Another lover of dense undergrowth. Ascends to 7,000 ft. Young out of nest 23rd April. Not uncommon.

183. The Plain-brown Tit-Babbler—*Proparus vinipectus*, Hodgs.

A small party was observed at Narkanda, Septr, 1918. Open, scrub-covered hill-side. Elevation 9,000 ft.

187. The Himalayan Whistling-Thrust—*Myiophoneus temmincki*, Vigors.

This cheerful songster is very common, wherever there is a rocky stream. Resident.

191. The Indian Blue Chat—*Larvivora brunnea*, Hodgson.

Not uncommon in the Sallow scrub above 8,000 ft. during the breeding season. Observed much lower in the cold weather. Nests end of May and June. Only one nest found containing four "Hedge-sparrow blue" eggs, 11th June 1916.

204. The Black-headed Sibia—*Lioptila capistrata*, Vigors.

Very common resident in well-wooded tracts. Breeding season end of April to August, but most nests found June and July. Eggs two or three.

219. The Stripe-throated Siva—*Siva strigula*, Hodgson.

In the cold weather flocks are seen at all elevations but in the breeding-season only found above 8,000 ft. One nest found in a Sallow sapling 4½ ft. from the ground, 30th June 1918. Elevation 8,600 ft. Three eggs as described by Mr. B. B. Osmaston, Journal, B. N. H. S., Vol XXV, No. 3, p. 494.

226. The Indian White-eye—*Zosterops palpebrosa*, Temm.

Common summer visitor. Breeds April to June.

232. The Yellow-naped Ixulus—*Ixulus flavicollis*, Hodgson.

Not rare in the cold season and a few pairs are seen during the breeding months. Occurs up to 8,000 ft.

235. The Red-billed Liothrix—*Liothrix lutea*, Scopoli.

Dodsworth obtained specimens below Sanawar in March 1913. Elevation 3,600 ft. In July 1918 I saw at least two males on Kasauli Hill, elevation 7,000 ft.

237. The Red-winged Shrike-Tit—*Pteruthius erythropterus*, Vigors.

Fairly plentiful in the well-wooded parts. Birds seen building in Deodar (*C. deodera*), Pine (*P. exelsa*, *P. longifolia*) and Spruce. Breeds May and June; but saw one brood out of nest, 20th May 1916.

241. The Green Shrike-Tit.—*Pteruthius xanthochloris*, Hodgson.

Not common. In the cold weather goes about with parties of Tits. Breeds April to June from 7,000 ft. upwards. One nest contained 4 highly-incubated eggs on 15th April 1917. Another nest described in Journal, Vol, XXIV, No. 2, p. 369.

260. The Fire-Cap—*Cephalopyrus flammiceps*, Burton.

This beautiful little bird is not uncommon about the Oak (*Q. incana*) forests in the breeding season. It arrives in the hills in March and nesting operations soon commence. Eggs usually four in number. The nest-hole is at various heights from ground, from 4 ft. to 40 ft. The nest itself is merely a pad of fine strips of dry grass. The female sits very close and if disturbed at the nest "puffs" at the intruder after the manner of Tits. The male has a delightful song.

261. The Spotted-wing—*Psaroglossa spiloptera*, Vigors.

A pair seen at Suni, Bhajji State in June 1913. Elevation 2,500 ft.

269. The Himalayan Black Bulbul—*Hypsipetes psaroides*, Vigors.

During the non-breeding season goes about in large noisy flocks. Breeds May and June. Eggs usually 3.

283. The Punjab Red-vented Bulbul.—*Molpastes intermedius*, A. Hay.
The common Bulbul of the lower cultivated valleys. Ascends to about 5,500 ft. Breeds May and June.

284. The White-cheeked Bulbul—*Molpastes leucogenys*.
Frequents the gardens in Simla, where it is common. Breeds April to June.

315. The White-tailed Nuthatch—*Sitta himalayensis*, Jard. and Selby.
Not common. A few pairs found in the Oak (*Q. incana*) forests. Breeds early in April. Eggs three to six.

323. The White-cheeked Nuthatch—*Sitta lencopsis*, Gould.
The habitat of this species appears to be above 8,000 ft. A pair seen going into a hole 100 ft. from the ground in a Spruce 19th May 1918.

327. The Black Drongo—*Dicrurus ater*, Hermann.
Very common in the lower valleys up to 5,000 ft. in summer. Breeds May and June.

328. The Indian Ashy Drongo—*Dicrurus longicaudatus*, A. Hay.
Common up to 8,000 ft. Breeds May and June.

341. The Himalayan Tree-creeper—*Certhia himalaynna*, Vigors.
Another very common species. Breeds March to May.

348. The Wall-creeper—*Tichodroma muraria*, Linn.
Not uncommon in the cold weather. A few remain till the beginning of April.

352 The Kashmir Wren—*Anorthura neglecta*, Brooks.
Appears in the cold weather. The first birds arrive about the end of October. By the end of March all have left again.

356. The Scaly-breasted Wren—*Pnoepyga squamata*, Gould.
Cold weather visitor. Some remain till mid April.

358. The Goldcrest—*Regulus cristatus*, Koch.
A winter visitor departing, as a rule, in March.

362. The Turkistan Grasshopper Warbler—*Locustella straminea*, Severtz.
A single specimen obtained, 25th May 1914. Elevation 7,000 ft.

366. Blyth's Reed-Warbler—*Acrocephalus dumetorum*, Blyth.
A bird of passage. In some years it swarms, in others not a bird is seen. Remains till beginning of June, but I have never heard the cocks singing up here. Returns in August.

372. The Brown Bush-Warbler—*Tribura luteiventris*, Hodgson.
Very uncommon. I found a pair in July 1914, with young scarcely able to fly. Elevation 8,600 ft.

374. The Indian Tailor-bird—*Orthotomus sutorius*, Forst.
A pair seen August 1917. Elevation 5,500 ft. A single bird seen, September, elevation 7,000 ft.

382. Franklin's Wren-Warbler—*Franklinia gracilis*, Frankl.
Occurs up to 4,000 ft. at which elevation it is commonly met with.

405. Tickell's Willow-Warbler—*Phylloscopus affinis*, Tick.
Probably not uncommon on migration. One obtained, April 1916. Elevation 8,600 ft.

406. Tytler's Willow-Warbler—*Phylloscopus tytleri*, Brooks.
Dodsworth procured this species. I feel certain it is a fairly regular Spring migrant. Its call note is feeble.

407. The Brown Willow-Warbler—*Phylloscopus tristis*, Blyth.
A few appear at the end of October. They must leave early in March for higher elevations.

413. The Grey-faced Willow-Warbler—*Phylloscopus maculipennis,* Blyth.

Only a single specimen procured. Probably uncommon.

414. The Orange-barred Willow-Warbler — *Phylloscopus pulcher,* Hodgson.

Procured both on Spring and Autumn migrations.

415. Pallas's Willow-Warbler—*Phylloscopus proregulus,* Pallas.

A resident species moving up to the higher elevations in summer. Breeds in the Deodar forests May and June at 8,000 ft. and upwards. One nest besides three eggs of this species contained one of the Himalaya Cuckoo (*C. saturatus*).

416. Brooks's Willow-Warbler—*Phylloscopus subviridis,* Brooks.

As far as my experience goes a rare migrant.

418. Hume's Willow-Warbler—*Phylloscopus humii,* Brooks.

By far the commonest species of this genus. Leaves these parts about the middle of May after which not one is seen.

422. The Greenish Willow-Warbler—*Acanthopneuste viridanus,* Blyth.

Passes through March to beginning of May, at which time it is here in thousands.

428. The Large-Crowned Willow-Warbler—*Acanthopneuste occipitalis,* Jerd.

A common breeding species. Lays from the beginning of May to June.

429. Blyth's Crowned Willow-Warbler—*Acanthopneuste trochiloides,* Sundev.

Dodsworth obtained one specimen.

433. The Black-browed Flycatcher-Warbler — *Cryptolopha burkii,* Burton.

Passes through April, May and June. Latest date 9th June. Not uncommon.

434. Hodgson's Grey-headed Flycatcher-Warbler—*Cryptolopha xanthoschista,* Hodgson.

A very common breeding species. Breeds end of March to June. Eggs four, rarely five.

450. The Pale Bush-Warbler—*Horornis pallidus,* Brooks.

This species is not uncommon during the breeding-season. Its song may be heard from April to August at elevations of 8,000 ft. and upwards.

455. The Rufous-capped Bush-Warbler—*Horeites brunneifrons,* Hodgson.

First obtained, October 1917, when a single specimen only was met with. In April 1918 it was passing through in considerable numbers. Frequents scrubby hill-sides.

458. The Brown Hill-Warbler—*Suya crinigera,* Hodgson.

Common on the open hill-sides up to 7,500 ft. Breeds May to July. Eggs four, rarely five. One seen on Mount Huttoo, elevation 10,469 ft.

473. The Bay-backed Shrike—*Lanius vittatus,* Val.

A few pairs ascend to about 5,000 ft. elevation where they breed about the cultivation in May and June.

476. The Rufous-backed Shrike—*Lanius erythronotus,* Vigors.

Very common about the cultivation up to 6,000 ft. in summer. Breeds May and June. Eggs four to six. The commonest fosterer to *Cuculus canorus.*

495. The Short-billed Minivet—*Pericrocotus brevirostris,* Vigors.

A common breeding species. Arrives in March and departs again the end of October or November. Breeds April to June.

499. The Rosy Minivet—*Pericrocotus roseus,* Vieill.
A pair procured, October 1916. Elevation 3,500 ft.

505. The Dark-grey Cuckoo-Shrike—*Campophaga melanoschista.*
Not uncommon in the cultivated villages up to 5,000 ft. They breed in May as a rule and the eggs number two or three.

518. The Indian Oriole—*Oriolus kundoo,* Sykes.
Common about the cultivated villages up to 5,000 ft. Breeds May and June.

544. The Black-headed Myna—*Temenuchus pagodarum,* Gm.
A few pairs ascend to about 5,000 ft. Young are out of the nests the end of May and June.

549. The Common Myna—*Acridotheres tristis,* Linn.
Found everywhere in the precincts of human habitations.

552. The Jungle Myna—*Æthiopsar fuscus,* Wagler.
Dodsworth found a small colony below Jutogh. They were breeding in holes in a cliff. Elevation 6,000 ft. Another colony breeds in the weep-holes in the pucca masonry buttresses supporting the bridge which crosses the Ashni River on the road from Simla to Junga. Elevation 4,000 ft. Lays end of May.

558. The Sooty Flycatcher—*Hemichelidon sibirica,* Gm.
Not uncommon on migration. Passes through end of April and returns in September. One nest containing young 20th July 1913. Another nest found June 17th 1918 contained three hard-set eggs. Both nests placed, on horizontal branches, some distance from the main stem of the trees (Deodars).

560. The Orange-gorgeted Flycatcher—*Siphia strophiata,* Hodgson.
Only a single specimen procured, one of a pair. Elevation 5,000 ft. Several seen in the Baghi forest during September 1918. Elevation 10,000 ft.

561. The European Red-breasted Flycatcher—*Siphia parva,* Bechst.
A few pass through on migration in April. A fine male obtained 2nd April 1916.

567. The Slaty-blue Flycatcher—*Cyornis leucomelanurus,* Hodgson.
Not uncommon as a breeding species in the dense undergrowth above 8,000 ft. Lays in May.

568. The White-browed Blue Flycatcher—*Cyornis superciliaris,* Jerd.
One of the commonest birds in Simla during the summer months. Lays April, May and June. Eggs three or four.

575. The Blue-throated Flycatcher—*Cyornis rubeculoides,* Vigors.
By no means common. Only a few observed. Two nests recorded, May and June.

579. The Verditer Flycatcher—*Stoparola melanops,* Vigors.
Another very common breeding species. Breeds April to June.

588. The Brown Flycatcher—*Alseonax latirostris,* Raffl.
On May 28th, 1916, I saw a bird with young out of the nest which I ascribe to this species. They were all so shy that I was unable to procure a specimen. No other record. Elevation 8,500 feet.

589. The Rufous-tailed Flycatcher—*Alseonax ruficaudus,* Swains.
Fairly common on migration—April and September.

592. The Grey-headed Flycatcher—*Culicicapa ceylonensis,* Swains.
Common breeding species. Lays April to June.

594. The Rufous-bellied Niltava—*Niltava sundara,* Hodgson.
Not uncommon in suitable localities. Breeds May and June.

598. The Paradise Flycatcher—*Terpsiphone paradisi*, Linn.

Common about the small hill-streams flowing through the cultivated areas up to 5,500 feet. Breeds May and June.

603. The Yellow-bellied Flycatcher—*Chelidorhynx hypoxanthum*, Blyth.

Occurs here in fair numbers both on the Spring and Autumn migrations.

605. The White-throated Fantail Flycatcher—*Rhipidura albicollis*, Vieill.

A few pairs ascend to about 5,000 feet. Breeds June and July.

608. The Common Pied Bush-Chat—*Pratincola caprata*, Linn.

Not uncommon up to about 6,000 feet in summer.

610. The Indian Bush-Chat—*Pratincola maura*, Pall.

Ascends to and breeds at fully 7,500 feet. Common. Eggs from four to six.

615. The Dark-grey Bush-Chat—*Oreicola ferrea*, Hodgs.

Very common. Lays March to June. Double brooded.

628. The Red-tailed Chat—*Saxicola chrysopgia*, De Filippi.

I obtained one specimen at Sairee on 29th September 1912 which Dodsworth recorded in the Journal, Vol. XXII, No. 1, page 196.

630. The Western Spotted Forktail—*Henicurus maculatus*, Vig.

Common along all the hill streams. Breeds April to June.

637. The Little Forktail—*Microcichla scouleri*, Vig.

Not uncommon. Its favourite haunts are the waterfalls along the courses of the hill streams. Breeds April and May.

638. The White-capped Redstart—*Chimarrhornis leucocephalus*, Vig.

A common winter visitor leaving these parts in mid-April and returning in October.

639. The Blue-fronted Redstart—*Ruticilla frontalis*, Vig.

Another winter visitor. Departs in March.

644. The Indian Redstart—*Ruticilla rufiventris*, Vieill.

Migrating downwards, October 1916, when a few were seen. Dodsworth procured it in Bhaghat state in March 1913. Elevation 3,600 ft.

646. The Plumbeous Redstart—*Rhyacornis fuliginosus*, Vig.

Only found along the hill streams where it is by no means uncommon up to 7,000 feet. Breeds April to July.

653. The Golden Bush-Robin—*Tarsiger chrysœus*, Hodgs.

Uncommon. One procured, April 8th, 1917. Elevation 6,000 feet.

654. The Red-flanked Bush-Robin—*Ianthia rufilata*, Hodgs.

Comes into Simla in the winter months and remains till mid April.

657. The Blue-headed Robin—*Adelura cœruleicephala*, Vig.

Appears towards the end of October, leaving again in March. Common.

661. The Brown-backed Indian Robin—*Thamnobia cambaiensis*, Lath.

Ascends the hill to 5,000 feet. Common at the lower elevation.

663. The Magpie-robin—*Copsychus saularis*, Linn.

A fair number come up to breed in the cultivated villages. Occasionally seen as high as 6,500 feet.

672. The White-collared Ouzel—*Merula albicincta*, Royle.

A few stragglers appear in Simla during the cold weather. One or two pairs remain to breed just North of this place. A nest found containing one egg, 16th May 1915. A brood seen following parents 2nd June 1918. Elevation 8,700 feet. The song is very feeble.

678. The Grey-headed Ouzel—*Merula castanea,* Gould.

Not uncommon in some winters. Not observed during the breeding season.

676. The Grey-winged Ouzel—*Merula boulboul,* Lath.

Common in well wooded localities. Nests found were invariably on trees. Lays April to July. Eggs two to four. A very fine songster.

677. The Black-throated Thrush—*Merula atrigularis,* Temm.

Begins to arrive in October and during the winter is here in thousands. In some years numbers do not depart till May. In habits and call-notes it resembles the Song Thrush (*T. musicus*).

678. Tickell's Ouzel—*Merula unicolor,* Tick.

An irregular autumn visitor. Some seasons not one is seen, in others it is fairly plentiful.

683. The Pied Ground Thrush—*Geocichla wardi,* Jerd.

Occurs very rarely as a breeding species. Dodsworth found a nest when I happened to be out with him. There were two young just hatched and two eggs on the point of hatching.

690. The Chestnut-bellied Rock-Thrush—*Petrophila erythrogastra,* Vig.

Not uncommon in forest where there are rocky banks and cliffs both of which appear to be essential to its economy. Breeds April and May. Eggs three or four.

691. The Blue-headed Rock-Thrush—*Petrophila cinclorhyncha,* Vig.

Common as a breeding species. Arrives in April. Lays May and June. Also a forest bird, does not ascend much above 7,500 feet.

693. The Western Blue Rock-Thrush—*Petrophila cyanus,* Linn.

A summer visitor appearing in April and departing in September or early October. Dodsworth took several nests in May and June but this species is by no means common. Its haunts are the bare rocky hills. Never found in forest.

695. The Missel-Thrush—*Turdus viscivorus,* Linn.

A resident species, neither common nor rare. Breeds above 8,000 feet. As far as my limited experience goes it appears to prefer a tree near the crest of a ridge on which to build a nest. Lays end of April and May.

704. The Large Brown Thrush—*Zoothere monticola,* Vigors.

Only a single specimen ever seen and procured. It was frequenting a small waterfall. Ovaries slightly enlarged 21st April 1916. Elevation 6,500 feet.

709. The Brown Dipper—*Cinclus asiaticus,* Swains.

Found all along the perpetual streams up to 6,000 ft. Breeds about these parts in January.

712. The Eastern Alpins Accentor—*Accentor nepalensis,* Hodgs.

A winter visitor appearing in small parties. Disappears by the end of March.

713. The Altai Accentor—*Accentor himalayanus,* Blyth.

Large flocks arrive about November, leaving again usually in March, though in a backward season, I have observed small flocks till mid-April. In the heat of the day this species exhibits a decided preference for the shady side of the hills.

715. The Robin Accentor—*Tharrhaleus rubeculoides,* Hodgs.

Only observed on one occasion. There was a pair and I shot one, but unfortunately failed to retrieve it.

716. The Black-throated Accentor—*Tharrhaleus atrigularis*, Brandt.

A not uncommon winter visitor. Single birds or a pair usually seen. Arrives October.

719. Jerdon's Accentor—*Tharrhaleus jerdoni*, Brooks.

A winter visitor, sometimes remaining till May. Single birds usually seen. Not uncommon in some years.

735. The Spotted Munia—*Uroloncha punctulata*, Linn.

Not a common bird in these parts. Ascends to 6,000 feet elevation.

741. The Black and Yellow Grosbeak—*Pycnorhamphus icteroides*, Vigors.

This is a resident species, coming right in to Simla in the winter. In the summer its haunts are the Deodar (*C. deodara*) forest just North and North-east of Simla where it breeds from 7,500 feet upwards. The seven nests of which I have records varied in height from 18 feet to 60 feet from the ground. Most nests are placed close to the main stem of the tree (Deodar and Spruce) but I found one placed, on a horizontal branch 10 feet away from the trunk, and had to extract the eggs with the aid of a spoon tied to the end of a stick. The materials of the nest are fine twigs, lichen and silvery plant-stems, with occasionally a little moss, lined with dry grass and rootlets. Both birds assist in building. Eggs (as described by Mr. Brooks in Hume's N. and E. 2nd edition), two or three, quite as often the former as the latter.

746. The Red-headed Bullfinch—*Pyrrhula erythrocephala*, Vigors.

Common winter visitor. Willow grown banks of streams are its favourite haunt. Leaves these parts end of April or beginning of May.

748. The Brown Bullfinch—*Pyrrhula nepalensis*, Hodgs.

Like its congeners a forest bird and as far as my experience goes only found above 9,000 feet, but probably descends to lower levels in winter. It has quite a melodious callnote.

750. The Himalayan Crossbill—*Loxia himalayana*, Hodgs.

In October 1916, I observed several small flocks and obtained a good view of them through my glasses. They were, however, very restless and I failed to secure any.

758. The Pink-browed Rose-Finch—*Progasser rhodochrous*, Vigors.

Plentiful in the winter months. Usually leaves in April but a few stragglers sometimes remain till May.

761. The Common Rose-Finch—*Carpodacus erythrinus*, Pall.

Very common in the cold weather. Leaves in April or beginning of May.

767. The Himalayan Goldfinch—*Carduelis caniceps*, Vigors.

A more or less resident species. Small flocks wander from one locality to another until they separate for the breeding season, about the middle of June.

768. The Red-browed Finch—*Callacanthis burtoni*, Gould.

Dodsworth procured this species in March 1911, and January 1912. He notes that it goes about in small flocks and is remarkably fearless.

771. The Gold-fronted Finch—*Metoponia pusilla*, Pall.

Abundant in the cold weather. Roams about the hill-sides in vast flocks which retreat to their breeding quarters generally in April.

772. The Himalayan Greenfinch—*Hypacanthis spinoides,* Vigors.
Resident, though the flocks wander away from their breeding haunts in the cold season and spring. Birds shot in April are moulting. Commences breeding operations in June which continue till September or, rarely, till October, for in 1916 I saw a brood of young ones which had not left the nest more than a day. This was on 29th of that month (October).

775. The Yellow-throated Sparrow—*Gymnorhis flavicollis,* Frankl.
Not uncommon up to about 4,000 feet elevation.

776. The House-Sparrow—*Passer domesticus,* Linn.
Abundant in Simla.

780. The Cinnamon Tree-Sparrow—*Passer cinnamomeus,* Gould.
Common up to at least 8,000 feet.

787. Stoliczka's Mountain-Finch—*Fringilauda sordida,* Stol.
Large flocks frequent the open spaces during the winter months. Leaves these parts in March.

792. The Pine-Bunting—*Emberiza leucocephala,* S. G. Gin.
Dodsworth procured a specimen on 23rd February 1913 at an elevation of 3,500 feet.

793. The White-capped Bunting—*Emberiza stewarti,* Blyth.
Abundant in the cold season. Leaves these parts in March, returning September and October.

794. The Eastern Meadow-Bunting—*Emberiza stracheyi,* Moore.
Breeds in Simla from April to September. Common.

803. The Crested Bunting—*Melophus melanicterus,* Gm.
Frequents the lower valleys up to 5,000 feet. Neither common nor rare. Breeds May and June and probably later.

805. The Kashmir Martin—*Chelidon Kashmiriensis,* Gould.
Large flocks of Martins appear in May. I have failed to secure a specimen but think they are probably the present species.

809. The Indian Sand-Martin—*Cotile sinensis,* J. E. Gray.
Occurs in fair numbers in the neighbourhood of Suni on the banks of the Sutlej. Elevation 2,000 feet.

810. The Crag-Martin—*Ptyonoprogne rupestris,* Scop.
Very plentiful in the cold weather. Both the Jungle-Crow and the Kestrel take toll of its numbers.

813. The Swallow—*Hirundo rustica,* Linn.
Only occasionally seen in Simla. Breeds at Suket City in the shops aligning tho main street. Elevation 3,000 feet.

818. The Wire-tailed Swallow—*Hirundo smithii,* Leach.
Not common. Returns year after year to the same locality for nesting purposes. Ascends to 7,000 feet.

822. Hodgson's Striated Swallow—*Hirundo nepalensis,* Hodgson.
Much more numerous than the foregoing species. Breeds commonly in Simla.

826. The White Wagtail—*Motacilla alba,* Linn.
Only observed on the downward migration during September. Elevation 6,000 feet.

829. The Masked Wagtail—*Motacilla personata,* Gould.
Occurs up to 7,000 feet on both the spring and autumn migrations.

831. The Large Pied Wagtail—*Motacilla maderaspatensis,* Gould.
A few pairs are found frequenting the larger streams.

832. The Gray Wagtail—*Motacilla melanops*, Pall.
Very common on both migration. Possibly a pair or two remain to breed as I saw a single bird on the Ashai River on May 24th, 1918.

837. The Yellow-headed Wagtail—*Motacilla citreola*, Pall.
Dodsworth procured a specimen in May 1912. Elevation 5,000 feet.

840. The Tree-Pipit—*Anthus trivialis*, Linn.
Common on migration in April and May, returning in September.

841. The Indian Tree-Pipit—*Anthus maculatus*, Hodgs.
One specimen obtained from a small flock, September 1918. Elevation 8,500 feet.

844. The Brown Rock-Pipit—*Anthus similis*, Jerd.
Not uncommon as a breeding species. Eggs taken as high as 7,000 feet. They are (the eggs) indistinguishable from those of *Oreocorys sylvanus*.

847. The Indian Pipit—*Anthus rufulus*, Vieill.
Occurs up to 2,500 feet or 3,000 feet down in the Sutlej valley, Bhajji State.

848. The Tawny Pipit—*Anthus campestris*, Linn.
Obtained by Dodsworth, January and February 1913. In his manuscript notes he remarked it was common, going about in small parties.

850. Hodgson's Pipit—*Anthus rosaceus*, Hodgson.
Dodsworth procured this species, February and March 1913.

851. The Water-Pipit—*Anthus spinoletta*, Linn.
A solitary specimen seen and obtained, which Mr. N. B. Kinnear kindly identified for me.

853. The Upland Pipit—*Oreocorys sylvanus*, Hodgson.
Resident. Breeds commonly from 4,000 feet to 8,000 feet, May to July.

888. Mrs. Gould's Yellow-backed Sun-bird—*Æthopyga gouldiæ*, Vigors.
A very local and rare species in these parts. Ascends the hills to 7,500 feet.

895. The Purple Sun-bird—*Arachnechthra asiatica*, Latham.
Ascends the hills in summer to 4,000 feet at which elevation it is not uncommon.

915. The Fire-breasted Flower-pecker—*Dicæum ignipectus*, Hodgson.
Resident. Moves up and down the hills according to season. Ascends to 6,000 feet elevation. Wherever parasitic tree plants (misseltoes) are numerous—this species is not uncommon between 2,000 feet and 6,000 feet.

919. Tickell's Flower-pecker—*Dicæum erythrorhynchus*, Latham.
A single specimen obtained, October 1916. Elevation 6,000 feet.

946. The West-Himalayan Scaly-bellied Green Wood-pecker—*Gecinus squamatus*, Vigors.
Abundant. Resident. Nesting April and May up to the highest elevations hereabouts. Six eggs are a common number in a clutch.

950. The Black-naped Green Wood-pecker—*Gecinus occipitalis*, Vigors.
Like the last, abundant, but does not ascend much above 7,500 feet. One nest found had the entrance only six inches from the level of the ground, the nest-chamber being below the ground-line.

951. The Small Himalayan Yellow-naped Green Woodpecker *Gecinus chlorolophus*, Vieill.

By no means common. Observed up to 7,000 feet.

961. The Western Himalayan Pied Woodpecker—*Dendrocopus himalayensis,* Jard. and Selby.

Fairly plentiful. Found up to 8,000 feet elevation. Resident. Eggs usually four.

967. The Fulvous-breasted Pied Wood-pecker—*Dendrocopus macii,* Vieill.

Dodsworth obtained this species near the Ashni River, Patiala State. Elevation 3,500 feet.

969. The Brown-fronted Pied Woodpecker—*Dendrocopus auriceps* Vigors.

Abundant everywhere up to about 7,500 feet. Nests in April as a rule. Eggs, generally four in a clutch.

986. The Golden-backed Woodpecker—*Brachypternus aurantius*, Linn.

Dodsworth obtained one specimenin Bhagrat State. Elevation 3,000 feet.

996. The Great Slaty Woodpecker—*Hemilophus pulverulentis*, Temm.

Dodsworth ebserved a party of these Woodpeckers in August 1907, *vide* Journal, B. N. H. S., Vol. XXI., No. 1, p. 263.

1001. The Speckled Piculet—*Picumnus innominatus,* Burton.

Not uncommon. Often found close to the ground climbing up dwarf bamboo or course grass. Ascends to 6,000 feet elevation.

1003. The Wryneck—*Iynx torquilla,* Linn.

Only a single specimen (male) obtained, 30th April 1916. Elevation 8,300 feet. Dissection showed that it would soon have been breeding. I have never heard its call in these hills and think the individual must have come some way out of its course.

1006. The Great Himalayan Barbet—*Megalœma marshallorum,* Swinhoe.

Common. Its wailing cry its heard in every wooded ravine up to 8,000 feet. Nesting season April to June.

1009. The Lineated Barbet—*Thereiceryx lineatus,* Vieill.

Found in the lower valleys up to about 3,500 feet of elevation. Common.

1012. The Blue-throated Barbet—*Cyanops asiatica,* Latham.

Uncommon. Observed up to 6,700 feet. (Dodsworth.)

1019. The Crimson-breasted Barbet—*Xantholœma hœmatocephala,* P. L. S. Mull.

Observed but rarely in the lower hills up to 2,000 feet, March 1912.

1026. The Common Indian Bee-eater—*Merops viridis,* Linn.

Ascends the hills to 5,000 feet. Breeding down on the banks of the Sutlej, June 1913. Elevation 2,200 feet.

1027. The Blue-tailed Bee-eater.—*Merops philippinus,* Linn.

In October 1915, I saw a large flock fly overhead, their call notes first attracting my attention. I record this with some hesitation, but at the same time I may mention I am well acquainted with this species in the Plains where I have taken its eggs. The birds were certainly bee-eaters and the notes I heard were those of *M. philippinus*. Elevation 8,000 feet. I made a note at the time regarding the meteorological conditions, which were misty and monsoony.

1034. The Himalayan Pied Kingfisher—*Ceryle lugubris,* Vigors.

A conspicuous bird on the large rstreams up to 4,000 feet.

1035. The Common Kingfisher—*Alcedo ispida,* Linn.
Ascends the hill-streams up to 5,500 feet. Not uncommon.

1044. The White-breasted Kingfisher—*Halcyon smyrnensis,* Linn.
Occasionally ascends to at least 5,000 feet. Uncommon.

1062. The Common Grey Hornbill—*Lophoceros birostris,* Scop.
Not uncommon in the jungles above Kalka. Goes about in small flocks. Observed up to 3,500 feet elevation.

1066. The European Hoopoo—*Upupa epops,* Linn.
Found in summer up to at least 8,000 feet. Frequents the barer hill-sides. Lays April, May and June. Common.

1068. The Alpine Swift—*Cypselus melba,* Linn.
Large scattered flocks are frequently to be seen in Spring and Autumn. Departs usually about the end of April, returning in October,

1072. Blyth's White-rumped Swift—*Cypselus leuconyx,* Blyth.
During the month of April 1917, which was unusually cold, large numbers were seen. Elevation 6,000 feet—8,000 feet.

1073. The Common Indian Swift—*Cypselus affinis,* Gray and Hardw.
Abundant as a breeding species in Simla. Arrives beginning of March and immediately commences breeding operations. Another brood is reared during the monsoon, July to September. Not observed above 7,000 feet.

1077. The White-necked Spine-tail—*Chætura nudipes,* Hodgson.
This bird must be considered very rare in these parts. I have only seen it twice, on each occasion a pair. The last time was when Mr. C. H. Donald was with me, May 1918. Elevation 8,000 feet.

1082. The Himalayan Swiftlet—*Collocalia brevirostris,* McClelland.
Dodsworth obtained one in February 1913. Elevation 4,000 feet.

1090. Franklin's Nightjar—*Caprimulgus monticola,* Franklin.
At a favourite spot which I used to visit almost every week during May and June, I used to hear the note of a Night jar, but could never get a good view of it. On describing the note to Mr. B. B. Osmaston he had no hesitation in ascribing it to this species. Elevation 8,000 feet.

1095. The Jungle Nightjar—*Caprimulgus indicus,* Latham.
Common on the barer hill-sides contiguous to jungle. Ascends to 6,000 feet.

1104. The Cuckoo—*Cuculus canorus,* Linn.
Abundant in the lower valleys up to 6,000 feet though I once procured a male above 8,000 feet. Arrives end of March or beginning of April. The commonest fosterer is L. erythronotus, but it also victimsies Bush-chats and Pipits. Occasionally it must also use the services of Bulbuls, for one egg taken in a nest of *M: leucogenys* was identified by Mr. E. C. Stuart Baker as pertaining to this species.

1105. The Himalayan Cuckoo—*Cuclus saturatus,* Hodgson.
Not nearly so plentiful as the last species. Ascends to at least 8,600 feet. First heard in April; all have ceased calling by the end of June. Eggs found in nests of Pallas's Willow-Warbler and the Large Crowned Willow-Warbler, the former slightly speckled, the latter spotless white. A young one found in a nest of *Cryptolopha xanthoschista.*

1107. The Indian Cuckoo—*Cuculus micropterus,* Gould.
Occasionally heard. Probably commoner at the lower elevations.

1114. The Banded Bay Cuckoo—*Penthocoryx sonnerati*, Latham.

Only once observed. Some White-cheeked Bulbuls were persistently attacking it as it perched on the tops of cactus bushes. I got a good view of it through my glasses, but it was too wary to allow me to approach within gunshot. Elevation 5,000 feet.

1118. The Pied Crested Cuckoo—*Coccystes jacobinus*, Bodd.

Very common in the cultivated areas up to 5,500 feet, and occasionally found as high as 8,000 feet. Much given to wandering at night. I have heard it calling at 11 p. m. at the latter elevation. Usually victimises *T. lineatum* in these parts.

1138. The Rose-ringed Paroquet—*Palæornis torquatus*, Bodd.

A male procured by Dodsworth in the lower hills. Elevation 3,000 feet.

1139. The Western Blossom-headed Paroquet—*Palæornis cyanocephalus*, Linn.

Occurs in these hills up to 5,000 feet at which elevation I found it nesting in 1918.

1141. The Slaty-headed Paroquet—*Palæornis schisticeps*, Hodgson.

A common woodland species. Does not appear to ascend above 7,000 feet. Most eggs are laid in April.

1138. The Himalayan Wood-Owl—*Syrnium nivicola*, Hodgson.

Not uncommon in and around Simla. Dodsworth was, I believe, the first ornithologist to find the egg of this species. The particular "nest" he took that egg from was placed in a small cave in a cliff. Since then I have found several "nests" all of which were in holes in trees, varying from 10 feet, to 35 feet from the ground. The eggs are two or three, perhaps more often the latter number. These are laid from the middle of March to the second week in April. Six eggs average 1·886 × 1·583 inch each. This owl has quite a variety of notes besides the usual "Who-hoo". One is a peculiar squawk which can easily be imitated by placing a blade of grass between the two thumbs of one's hands and blowing sharply on the edge of the grass-blade. Another is very similar to the note of the domestic pigeon when he is showing off before the female. Barely more than one young one is reared to maturity. I have never found anything but rats in the nest-hole. Numbers of pellets found near their nests and under their rooting-places have never contained remains of birds. A really useful bird.

1160. The Brown Wood-Owl—*Syrnium indrani*, Sykes.

This grand owl must be considered very rare about Simla. I have twice found its nest, in each case in a hole in a tree. On the first occasion there was only one egg on the point of hatching, 29th April. The second nest contained two young about a week old on the 14th April. I have only heard this owl using two different cries. The first is very much like that of the male domestic pigeon. The others is a low, sonorous squawk. The latter is a note of alarm, I am inclined to think. No notes regarding food of this powerful bird, but one would imagine it capable of taking a pheasant or even a fowl, with ease. One egg measured 2·15 × 1·74 inches.

1175. The Spotted Himalayan Scops Owl—*Scops spilocephalus*, Blyth.

Fairly plentiful in the Oak and Rhododendron forests up to 8,000 feet. Usually lays in April.

1183. The Large Barred Owlet—*Glaucidium cuculoides*, Vigors.

Like the last species, but does not ascend much above 7,000 feet. Eggs are laid end of April and beginning of May.

1184. The Jungle Owlet—*Glaucidium radiatum*, Tickell.

Only observed in Suket State where it was fairly common at 3,000 feet.

1186. The Collared Pigmy Owlet—*Glaucidium brodiei*, Berton.

Neither common nor uncommon. Found up to at least 8,500 ft. Frequently to be seen on the move during the day-time. A female shot 28th April contained an egg almost ready for expulsion.

Its note is "Hoot-ootoot-oot".

1190. The Cinerous Vulture—*Vultur monachus*, Linn.

So rare that it might almost be omitted from this list. Dodsworth came across it on two or three occasions and I have seen it once near Billaspur, elevation 2,500 ft.

1191. The Black or King Vulture—*Otogyps calvus*, Scop.

Fairly common up to 8,000 ft. Breeds up to at least 5,800 ft. Several nests examined, in each instance these were placed on the flat tops of Deodars (*C. deodara*). All the nests were solitary, built of fine and coarse sticks and lined with dry grass-tufts. Most nests contained young in April, but I secured one egg, almost ready to hatch, on the 8th of that month.

1193. The Himalayan Griffon—*Gyps himalayensis*, Hume.

Perhaps the commonest vulture found round Simla. Breeds on cliffs. Most eggs are laid in January.

1196. The Indian White-backed Vulture—*Pseudogyps bengalensis*, Gm.

Another common vulture in these hills. Large congregations are frequently seen below the Simla slaughter-houses. Ascends to 8,000 ft. Dodsworth found it breeding above Kalka up to 3,600 ft. of elevation.

1197. The Smaller White Scavenger Vulture—*Neophron ginginianus*, Latham.

A partial migrant. Numbers are seen about Simla during the summer but nearly all descend to the lower hills in winter. Lays in May. Eggs one or two. Nests on cliffs.

1199. The Bearded Vulture—*Gypaëtus barbatus*, Linn.

This grand bird is a not uncommon resident about Simla. Usually it will be observed sailing round the hills at no great elevation from the ground but at times will be seen soaring gracefully at great heights. As the breeding season approaches a pair will be seen playing in the air when after a certain amount of flapping they grasp each others talons and come tumbling towards earth, only releasing their grip when within a few yards of it. They pair on the rocks near their nest. Eggs, one or two, are laid from December to March. A very silent bird, though rarely it gives vent to a squeal. Never seen on a carcase.

1200. The Golden Eagle—*Aquila chrysaëtus*, Linn.

A single specimen observed at an elevation of 10,000 feet, near Narkanda. Mr. C. H. Donald assures me he has often seen this species about the same locality.

1202. The Steppe Eagle—*Aquila bifasciata*, J. E. Gray.

A common cold season visitor. Appears towards the end of October, leaving again in March and early in April.

1207. Bouelli's Eagle—*Hieraëtus faciatus*, Vieill.

Rare. During ten years' observation I have only seen it on very few occasions. Probably it becomes less rare nearer the plains.

1208. The Booted Eagle—*Hieraëtus pennatus*, Gmel.

A single specimen was observed during Sept. 1918. Elevation 10,000 feet.

1210. The Black Eagle—*Ictinaëtus malayensis*, Reinw.

Excessively rare. Only observed on one occasion, June 1917. It was then beating slowly over forest, pursued and buffetted by all the Drougos in the vicinity. Elevation 7,000 feet.

1213. Hodgson's Hawk-Eagle—*Spizaëtus nepalensis*, Hodgson.

Not uncommon. Usually seen hunting in pairs over dense forest, or seated on trees commanding a good aspect of the surrounding jungle. Breeds in February and March, both on cliffs and large trees. Eggs one or two.

1216. The Short-toed Eagle—*Circaëtus gallicus*, Gmel.

One observed hovering over the bare hill-side at Kufri, while I was watching it through my glasses two Hobbies and a Kestrel repeatedly stooped at it. Elevation 8,000 feet.

1217. The Crested Serpent-Eagle—*Spilornis cheela*, Latham.

A few pairs breed in well-wooded and well-watered nullahs round Simla. Lays about the end of March and beginning of April. Breeds up to 6,500 feet.

1223. Pallas's Fishing-Eagle—*Haliaëtus leucoryphus*, Pall.

I was surprised at seeing a specimen of this Eagle soaring above the hills between Theog and Mattiana. Elevation 8,000 feet.

1228. The Brahminy Kite—*Haliastur indus*, Bodd.

One or two are to be seen every year about the Ashni River, a few miles below Simla Elevation. 5,000 feet.

1229. The Common Pariah Kite—*Milvus govinda*, Sykes.

Abundant in the immediate vicinity of Simla up to 8,000 feet of elevation. Breeds March to June.

1232 The Black-winged Kite—*Elanus cæruleus*, Desf.

Only observed on one occasion, September 1912, at an elevation of 4,500 feet.

1235. The Hen-Harrier—*Circus cyaneus*, Linn.

Appears in October in fair numbers. Usually seen quartering the open hill-sides. Departs in March.

1237. The Marsh Harrier—*Circus æruginosus*, Linn.

Seen only on one occasion, May 1918. Elevation 8,500 feet.

1239. The Long-legged Buzzard—*Buteo ferox*, S. G. Gmel.

Fairly abundant in the winter months. Usually commencing to appear in October, leaving in March.

1244. The Shikra—*Astur badius*, Gmel.

Uncommon; one or two are seen each season. Dodsworth shot one at 6,700 feet of elevation.

1247. The Sparrow-Hawk—*Accipiter nisus*, Linn.

During migration Sparrow-Hawks are not uncommon but as a breeding species must be accounted rare here. I have only found two nests. One contained three very hard-set eggs, the other three nearly fledged young ones. I shot the male bird from the first and it appears to agree well with Blanford's description of this species in the "Fauna" B. I. Vol. III, page 402. Another male I have, also appears to agree with Blanford's description, but Mr. C. H. Donald, to whom I showed these two skins, considers them very dark on the upper plumage and unlike the Sparrow-Hawks he has been used to seeing in the Kangra District and elsewhere. Since he drew my attention to this difference I have looked up my notes when these birds would be migrating and carefully recalled to memory whether they were pale or dark specimens, and am confident in saying that during the migration season the great majority (males) seen were the pale race. Birds seen in May and June were invariably of the darker race and at that period would be breeding. Hence, as Mr. Donald says, it looks as though the latter is a local, non-migratory race, in fact Hume's *malanoschistus.*

1255. The Shahin Falcon—*Falco peregrinator,* Sundew.

A rare resident. I know of only two pair breeding and frequenting the neighbourhood of Simla. Its eyrie is always placed on a ledge in some almost inaccessible precipice. The eggs, two or three in number, are laid in March and April, and in four instances when I have taken the eggs these have reposed on the bare earth.

1257. The Luggar Falcon—*Falco jugger,* J. E. Gray.

A pair found breeding in a cliff on the banks of the Sutlej near Bilaspur, March 1912. Elevation 2,000 feet.

1260. The Hobby—*Falco subbuteo,* Linn.

Not uncommon on migration and a few pair remain to breed. I have thrice found the nest, twice with young and once with eggs, see "Journal" Vol. XXIII, No. 3, page 579 and Vol. XXIV, No. 2, page 359. Breeds in June. Its food consists principally of coleopterous insects but I have on more than one occasion seen it take swifts (*C. affinis*).

1265. The Kestrel—*Tinnunculus alaudarius,* Linn.

Kestrels are common throughout the year but whether those that breed with us are replaced in the winter by others from further North it is impossible to say. Lays in April, May and June. Most nests were between 6,000 feet and 7,000 feet, but I have one clutch of eggs taken below 6,000 feet.

1283. The Kokla Green Pigeon—*Sphenocerus spenurus,* Vigors.

A common breeding species. Arrives April when its peculiar call is heard in every heavily wooded Oak (*Q. dilatata*) forest up to about, 7,000 ft. Very few are seen after August. Breeds in May and June. One nest contained three eggs.

1291. The Bronze-winged Dove—*Chalcophaps indica,* Linn.

Dodsworth obtained specimens of this species at 3,500 ft. elevation in February 1913. He opined that it was tolerably abundant.

1292. The Indian Blue Rock-Pigeon—*Columba intermedia,* Strickl.

Breeds in a few secluded cliffs. I have seen it nesting in the same cliff as *Gyps himalayensis* and again in close proximity to *Gypætus barbatus.* Elevation 5,000 feet.

1293. The Blue Rock-Pigeon—*Columba livia,* Bonnaterre.

Dodsworth obtained specimens of this species, together with hybrids between this and the last species, from a flock he came across during February 1913. Elevation 4,000 ft.

1298. The Eastern Wood-Pigeon—*Palumbus casiotis,* Bonap.

During some winters large flocks are seen. Most have retired further North by the end of March but occasionally a few remain till mid-April.

1305. The Indian Turtle-Dove—*Turtur ferrago,* Eversm.

Very common in forest up to 8,500 ft. elevation.

1307. The Spotted Dove—*Turtur suratensis*, Gm.

Also very common. Frequents cultivated tracts up to 6,000 ft. elevation.

1309. The Little Brown Dove—*Turtur cambayensis*, Gm.

Occurs up to 2,000 ft.

1310. The Indian Ring-Dove—*Turtur risorius*, Linn.

Not uncommon about the cultivation up to 6,000 ft.

1324. The Common Peafowl—*Pavo cristatus*, Linn.

Not uncommon up to 5,000 feet, but rarely seen above 6,000 feet.

1328. The Common Jungle-fowl—*Gallus ferrugineus*, Blyth.

Common in the outer hills up to 4,000 feet of elevation and Mr. E. C. Stuart Baker mentions a clutch of 8 eggs which he received from Dodsworth taken in Simla. J. B. N. H. S. Vol. XXV, No. I, page 8.

1333. The Cheer Pheasant—*Catreus wallichi*, Hardwicke.

Only found in a few favoured localities about Simla. During the early part of 1917, a young sportsman here shot a beautiful male, hybrid between this species and *Gennæus albiæristatus* which is now in the Society's museum.

1334. The Koklas Pheasant—*Pucrasia macrolopha*, Gray.

This splendid sporting bird is fairly plentiful in the Deodar forests between 7,500 and 8,500 feet. Its usual haunts in the shooting season are the more or less open forests where there is a good growth of grass, and except when disturbed appears to shun the dense undergrowth. In the breeding season the reverse is the case. Lays during the last week in April and the beginning of May. Pahari name, "Plaash."

1336. The White-crested Kalij Pheasant—*Gennæus ablicristatus*, Ogilvie Grant.

Found in almost every ravine where there is sufficient undergrowth to afford it cover. Most eggs are laid in May and June.

1342. The Monal—*Lophophorus refulgens*, Temm.

Scarce until one gets at least 30 miles out of Simla.

1345. The Western Horned Pheasant—*Tragopan melanocephalus*, Ogilvie Grant.

Very rare. A few are shot in most seasons towards Kotgarh above 9,000 feet.

1355. The Common or Grey Quail—*Coturnix communis*, Bonn.

I have shot it when out after Chukor but consider their occurrence rather exceptional. Elevation 4,000 feet.

1357. The Jungle Bush-Quail—*Perdicula asiatica*, Adams.

Not uncommon in the lower scrub-covered hills up to 3,000 feet of elevation.

1362. The Common Hill-Partridge—*Arboricola torqueola*, Gray.

Such an arrant skulker that it is considered scarce. This. however, is by no means the case, it being tolerably plentiful wherever there is an abundance of dense undergrowth. Observed up to 8,600 feet.

1370. The Chukor—*Caccabis chucar*, Blyth.

Fairly plentiful in suitable localities, *i.e.*, the bare stony hill-sides, more or less dotted with low bushes, generally near cultivation. From 4,000 feet of elevation, upwards.

1372. The Black Partridge—*Francolinus vuglaris*, Steph.

Found everywhere except in high forest. Its favourite haunts, however, are in the vicinity of villages. Occurs up to 8,500 feet near Simla. Breeds June and July.

1375. The Grey Partridge—*Francolinus pondicerianus,* Steph.

Occurs up to about 4,000 feet of elevation.

1384. The Indian Button-Quail—*Turnix tanki,* Blyth.

In July 1913 I procured one of a pair seen. This is the only record of this species. Elevation 5,500 ft.

1393. The Eastern Baillon's Crake—*Porzana pusilla,* Oates.

One was caught in one of the European shops in the Mall. It was kept in a cage for a week and was given to me when it died.

1405. The Coot—*Fulica atra,* Linn.

A single record only. This specimen was caught by one of our dogs when out after Chukor. Elevation 4,000 feet.

1431. The Red-wattled Lapwing—*Sarcogrammus indicus,* Sharps.

Occurs in small numbers along the streams up to 5,000 feet of elevation.

1460. The Common Sandpiper—*Totanus hypoleucus.* Temm.

Common along the streams during migration.

1462. The Green Sandpiper—*Totanus ochropus,* Temm.

Same as the last.

1466. The Greenshank—*Totanus glottis,* Bechst.

Observed at a small pond at 7,000 feet of elevation. Often heard flying over at night during migration.

1482. The Woodcock—*Scolopax rusticola,* Linn.

Not uncommon during the cold weather. It is not improbable that a few remain to breed as I have on two occasions flushed it during the month of June.

1526. The Cormorant—*Phalacrocorax carbo,* Linn.

While marching from Bilaspur to Suket in March 1913 I saw several cormorants, which, judging from their size, I attributed to this species.

1555. The Common Heron—*Ardea cinerea,* Linn.

Occasionally seen and heard on migration.

1565. The Pond Heron—*Ardeola grayi,* Hume.

Only one record—a single bird seen at the Ashni River, 8 miles from here. Elevation 4,000 feet.

1579. The Grey Lag Goose—*Anser ferus,* Schaeff.

A flock of about 200 birds flew over Simla on March 4th, 1918 Their well-known call attracted everyone's attention.

1588. The Ruddy Sheldrake—*Casarca rutilla,* Bonap.

A small party were seen on the Sutlej in September 1909.

1601. The Garganey—*Querquedula circia,* Steph.

Three were shot from a small flock at the beginning of September 1909. They were feeding in a small marsh on the banks of the Sutlej. Elevation 2,500 feet.

1602. The Shoveller—*Spatula clypeata,* Boie.

At daybreak while locating Chukor two flew over out of gunshot. They appeared to be making straight for the plains, September 1912. Elevation 4,000 feet.

SOME SOUTH INDIAN COCCIDS OF ECONOMIC IMPORTANCE. (*a*)

BY

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The economic importance of Coccidæ (scale insects and mealy bugs) needs no special mention—especially in tropical countries. Though this is well known in tropical America, Australia and South Africa, the fact is not so well realised in India. The causes that contribute to this paucity of our knowledge regarding this group of insects are many. In the first place these insects have a partiality for fruit trees, garden shrubs, and hot house plants, and in India there is hardly anything compared to the extensive fruit cultivation and horticulture found in those countries. Except on the hill ranges where some attempt is nowadays being made to grow fruits, and around some big cities where nursery men ply their trade, there is nothing worth the name of fruit culture anywhere in the plains; this is specially the case in South India. Secondly, though several species of Coccids are found in India, except in a few cases damage to the ordinary cultivated crops by these insects is very little, compared to others like beetles and caterpillars with which agriculturists are more familiar.

But nowadays, however, there is a tendency and desire on the part of both European settlers and Indian landlords in different parts of India to take to gardening and fruit culture in addition to the time-honoured custom of growing only the staple food and industrial crops. To these prospective gardeners and orchardists a knowledge of the Coccids of the country—especially of those forms which are of some economic importance—will, I believe, be of some use and it is chiefly with this idea of contributing a little in this direction that this paper is read.

In the course of a systematic study of the species of this interesting group of insects found in South India, I have had chances of noting some forms which, judging from their present status, bid fair to play some prominent part as insects of economic importance in course of time. At present most of the species are found confined to various wild trees and shrubs, and some of the well-known fruit pests of the group so far known in the country have not as yet spread sufficiently to attract any serious attention.

(*a*). This is a paper which was read at the Indian Science Congress, Lahore, in January 1918.

But as the area under fruit is increasing gradually and forests are cleared for cultivation, several of these forms might, under favourable circumstances, transfer their activities not only to fruit trees and garden plants but even to food and industrial crops grown in the fields. Nor do the chances for wider distribution stop there ; nursery men and fruit vendors have begun to import fruit and nursery stock from foreign countries and this will be another important medium for the importation of some of the well-known scale pests from abroad. In this manner Coccids have good opportunities of coming into more prominence in the future.

I have in this paper attempted to list those forms which have so far been noted to be of some economic importance and a few which show promise of playing the role of pests in due course. So far I have noted about 129 species of Coccids inhabiting South India and of these I have selected the following 33 which are of economic importance and therefore deserve some attention.

FAMILY—COCCIDÆ.

Sub-family—DIASPINÆ.

1. *Chionaspis vitis,* Green.*

Found on Mango in Bangalore, Coimbatore and at the foot of the Nilgiris. The female scales are white and more or less transparent and oval in shape, the male puparia are small and snowy white. The insect is found in colonies on the foliage and infested leaves turn into a pale sickly yellowish colour. It is not at present a very serious pest but it is not unlikely to be so. The alternate food plants on which this insect has been noted are *Vitis lanceolaria, Elæagnus latifolia* and occasionally *Loranthus.* Mr. Green who has studied the insecty in Ceylon says " should the grape vine be ever cultivated largely in Ceylon, this insect might prove a rather serious pest." The remark applies equally to South India.

2. *Diaspis echinocacti*—Bouche.*

This is the prickly pear scale. Found in Coimbatore and other localities. The small pale whitish brown oval scales are found in patches on the prickly pear. The colonies are especially numerous near the branches of thorns and flower buds. During the summer months the insect multiplies enormously and considerably checks the vigorous growth of this undesirable weed, but it has not begun to play a very important role as a natural enemy of the prickly pear.

3. *Hemichionaspis aspidistræ,* Sign.*

This insect has been noted on a variety of plants till now. On pepper leaves and berries in Malabar, on Ceara rubber leaves on the Nilgiris, on Citrus leaves in Godavari, on Jak leaves in Mysore, on Ficus leaves in Coimbatore and Cocoanut leaves in Malabar. The female puparium has an irregular elongated shape pointed at one end and more or less dilated at the posterior end. Has a pale brown colour. The male puparia are small, narrow, and clear white in colour. It is curious that in certain cases males predominate and in others only female scales are found.

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* NOTE.—All the species with an asterisk werenamed by Mr. E. E. Green.

This insect is important from an economic point of view as it has been noted on a variety of plants in different places and in some causing an appreciable amount of damage. Has been noted to cause severe damage to young arecapalms.

4. *Hemichionaspis theæ,* Mask.*

This insect resembles 'H. aspidistræ' very closely. The male scales are arranged on the leaves in definite groups and are often found far more numerous than the female scales. Found on pomegranate leaves—Coimbatore and Tea in Assam. In Assam it is often found to be serious especially on young tea bushes. It is likely that the insect is present in the tea districts of South India also.

5. *Aspidiotus destructor,* Sign.*

Found on cocoanut leaves all along the West Coast, in Tinnevelly and in Coimbatore. The transparent yellowish white oval scales are found in large patches on fronds that are badly infested. In some places some appreciable damage is done by this insect. The effect of the infestation consists in the leaves getting faded and shrivelled up and the colour turns to a sickly pale yellowish white. The insect has also been noted on pepper, Para rubber, *Loranthus,* etc.

6. *Aspidiotus camelliæ,* Sign.*

This is the well known 'yellow bark louse' of tea. The scales are oval and have a pale yellow colour ; they resemble small oyster shells overlapping one another. Noted on elm in Ootacamund. Also recorded on *Grevillea, Cinchona,* and *Michelia* in Ceylon. This is often a bad pest of young tea on the Nilgiris; in these cases the upper shoots are covered over by the scales and killed outright. The scales can be easily made out on infested plants due to their conspicuous appearance.

7. *Aspidiotus* (*Chrysomphalus*) *aurantii,* Mask.*

This is the *citrus* red scale of American states, but it has not yet become so serious a pest in India. Has been found on Rose bushes, Malabar, and on Jasmine leaves, Godavari District. I have not yet found it on *citrus* in South India. It has been recorded on Agave, Pomelo and Orange plants in Ceylon. This is evidently one of those insects regarding which orange cultivators may be warned. On rose bushes it is found very bad, killing shoots, stem and leaves of infested plants. The circular greyish brown transparent scales cover the shoots and foliage in masses.

8. *Aspidiotus ficus,* Ashmead.*

This is another well known insect and has an equally wide distribution. The small more or less conical purplish scales are often found crowded together on citrus leaves. Noted on Ficus in Anantapur Mango in Coimbatore, Citrus in Malabar and Nilgiris and on Pandanus in Cochin. This has not been found to be so bad as '*A. aurantii.*'

9. *Mytilaspis piperis,* Green.*

This is the only species of the genus of mussel scales that has been found to be a pest so far. It is noted on black pepper infesting the tender vines and the foliage in North Malabar and Wynaad. In some plantations in Wynaad and Travancore severe damage has been recorded. An infested vine cannot easily be made out as the colour and general appearance of the scales resemble the corrugated surface of the vine.

Sub-family—LECANIINÆ.

10. *Pulvinaria psidii*, Mask.*

This is one of the most important of Coccid pests at present known in South India. It is popularly known as the 'Guava mealy scale.' Though it is very often found bad on the guava plant it has been noted to do damage to a variety of others, the chief of them being coffee, tea, mango, *Citrus* and *Morinda*. The young and fairly mature scales are bright green in colour more or less resembling the green bug of coffee, but the mature female throws out a white ovisac and this is found in numbers on badly infested plants. A black mould also forms in course of time and gives a completely blighted appearance to the plants affected. It is found throughout South India especially in the hill plantations.

11. *Pulvinaria maxima*, Green.*

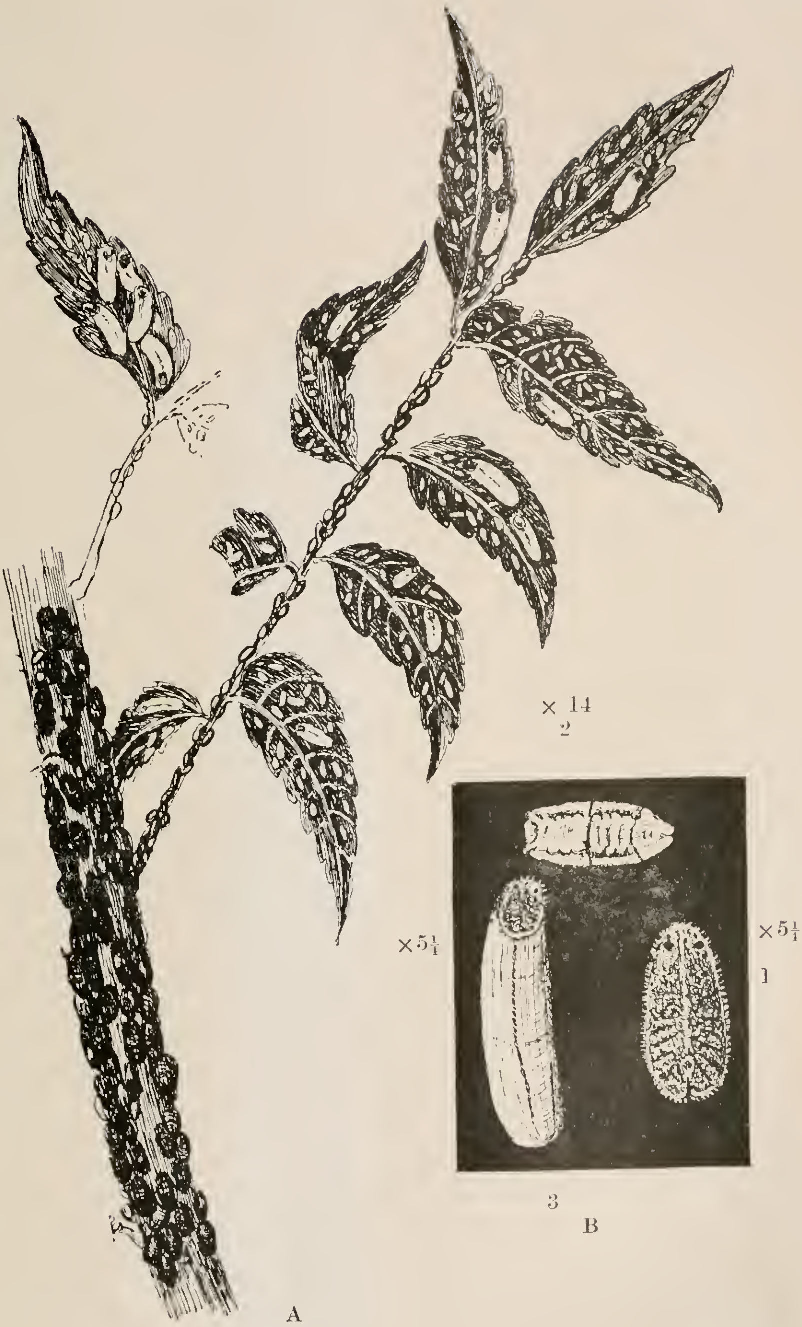
This is also a destructive species almost chiefly confined to the Margossa (nim) tree and found in most parts of South India chiefly in and around Coimbatore. Almost throughout the year the pest can be found on trees in varying numbers. A badly infested tree shows all the stages of the pest in numbers; the male puparia are small and white and cover the whole surface of the plant, leaves, shoots and stem. The adult females are pale brown leathery objects generally found attached to the tender shoots and stems; when about to oviposit they spread themselves to the leaves and branches and deposit the long curved ovisac so conspicuously seen on infested plants. The adult males are tiny delicate two winged creatures with a pair of long processes at the tail end. A small lady bird beetle is also found predacious on this scale. The common black ant '*Camponotus compressa*' visits the scale in colonies, and nests of this ant are found underneath these trees. The insects throw out so much secretion that the ground below becomes completely wet and the foliage of the lower branches becomes covered with black soot giving the characteristic blighted look. There is every likelihood of this insect spreading to other plants and trees also. Recently mulberry plants were found attacked in Coimbatore. The insect was first described by Green from Javanese specimens collected on *Erythrina lithosperma*.

12. *Pulvinaria thespesiæ*, Green.*

This species is in structure and habits very similar to the preceding species. I have noted this pretty bad on the Portia tree (*Thespesia populnea*) which is a very common avenue tree along the coast roads of the Godaveri district near Cocanada, Coringa, etc. The long, curved ovisacs are very big and prominent and found in masses on the leaves and shoots. This was first described from Ceylon on the same plant and has not been recorded from India till now.

13. *Creoplastes actiniformis*, Green.*

This pretty looking reddish brown waxy scale is found on a number of plants and though it has not yet assumed the role of a pest there are signs that it might prove a destructive species. Found on Cocoanut leaves (Coimbatore and Malabar), Mango leaves (Coimbatore), on Canna leaves (Samalkota, Godavari), on *Ficus* (Anantapur) and on *Calophyllum* leaves (South Canara). The scale is often found in large colonies along the unfolded inner surface of the cocoanut leaves in Malabar. On *Calophyllum* it was found doing some appreciable damage. The octagonal arrangement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3
B
A

PULVINARIA MAXIMA, Gr.

A.—Scale infested branch of Nim.

B.—1. ♀ adult. 2 ♂ puparium. 3. ♀ with ovisac.

of the spherical waxy test into plates gives this insect an ornamental appearance. It is recorded on *Loranthus* in Poona.

14. *Ceroplastodes cajani*, Mark.*

Found on Red gram all over South India. It is also found doing some damage to the main vines of '*Dolichos lablab*,' to shoots of *Zizyphus jujuba* and the sacred 'thulsi' plant (*Ocimum sanctum*). The scales are small and oval and covered with white glassy tests of wax. Big patches of these are found on Red gram and lablab stems. A species of '*Eublemma*' moth is found predacious on this insect. This insect was first described by Maskell under the name of '*Eriochiton cajani*,' from specimens collected at Madras on Red gram in 1891.

15. *Lecanium nigrum*, Neit.*

This is popularly known as 'the black scale' and has a world-wide distribution. The scales are of a dark shining brown colour and have an irregularly oval shape with the dorsal surface strongly convex. The scales cover the shoots and leaves in numbers. In Coimbatore it has been noted on Cotton, *Thespesia populnea*, *Hygrophila spinosa*, Sandalwood, garden crotons, and *Hibiscus esculentus*. Sometimes it does considerable damage. Some of the *Thespesia*, avenue trees in parts of Mysore are bad with this pest. Besides the above it has been noted on coffee, tea, rubber, etc., in different parts of India. It is badly parasitised by a chalcid very often.

16. *Lecanium hemisphæricum*, Targ.*

This is one of the two or three well known Coccid pests of South India—'the brown bug of coffee' and has been noted throughout the world on various food plants. Sometimes it is very bad on coffee in the hill plantations. It also infests tea, guava, cinchona and other plants. The scales are oval and hemispherical and have generally a reddish brown colour.

17. *Lecanium oleae*, Bern.*

A very convex purple brown scale with prominent ridges on the surface. This is not so common as the two previously mentioned species of '*lecanium*.' It is found on Tamarind fruits and stalks and on *Hyrgrophila spinosa* (Coimbatore), on coffee (Coorg), and on *Sesbania* and *Thespesia* (in the Bellary District). This is the common 'olive scale' of European countries.

18. *Lecanium viride*, Green.*

Among coccid pests so far known in South India this insect appears to be one of very great importance as a pest. It is popularly known as the 'green bug' of coffee and tea in the hill plantations of South India and a good deal is on record regarding this insect. Besides coffee and tea which it regularly infests it has been noted on *Aegle* and *Carissa* (Coimbatore) and Guava, Citrus and *Plumeria acutifolia* on the Nilgiris. It is often found together with the 'brown scale.'

19. *Hemilecanium imbricans*, Green.*

This scale is of a fairly big size about ½″ across and has a rough circular shape. The dorsum is slightly convex. In colour the scale is dirty brown and in many cases very closely resembles the stem of the host plant. Noted on '*Jatropha multifida*' and *Ailanthus excelsa* (Coimbatore) and Cedar (Shevaroys). It has been noted before on *Ficus* sp. and Red cedar in Mysore; on these trees it is a pretty bad pest. Masses of the scale and its young are found completely covering the stem and shoots of the host plant and this gives a glistening white appearance to the stem. A black mould follows the attack and the tree suffers to an appreciable degree. It is probable that this insect might in course of time assume the status of an important pest of some of our valuable trees.

Sub-family—Dactylopiinæ.

20. *Dactylopius indicus,* Green*.

This is the well known wild cochineal insect producing the beautiful purple dye. Though this is not commonly found I found it pretty abundant on the prickly pear plant in parts of the Godavari district. The soft mealy covered females are found crowded together on the surface of the prickly pear foliage, and the male puparia which are shining white small cocoon shaped objects are also found clustered near the thorn bunches. The insect seems to effectively destroy prickly pear of the species *Opuntia monacantha* though my efforts to inoculate the sâme on the common South Indian species '*O.dileni*' did not meet with success. The dye got out of this insect is a brilliant purple one.

21. *Pseudococcus citri,* Risso.

A well known mealy bug found throughout the world and doing serious damage to different plants in various countries. It has over forty host plants. I found it bad on Cocoa plants grown in the Government gardens, Kallar (Nilgiris). Large white patches of this bug were found covering the growing pods. It has been noted before on Coffee seedlings in Mysore and Coorg.

22. *Pseudococcus virgatus**.

This is another mealy bug very commonly found in South India infesting a variety of garden plants such as croton, tomato, *Sesbania, Hibiscus* (in Coimbatore), Cambodia cotton (in South Arcot), etc.

23. *Pseudococcus sacchari,* Ckll. †

This mealy bug is found infesting the inner surface of the leaf sheaths of the growing paddy plant. Sometimes this does considerable damage to paddy in parts of Trichinopoly and Tanjore. It is known as the 'choorai' disease on paddy. Infested fields show isolated patches of plants drying up.

24. *Pseudococcus corymbatus,* Green. (MS name only.)*

This is another destructive mealy bug which produces large masses of white mealy matter. Noted on Jak (in Malabar), On citrus shoots and fruits (in Godavari District), and on Cotton plants (Coimbatore). The shoots and fruits of the host plants are covered over with thick masses of the white mealy matter under which the bugs live. In Malabar the red ant *Oecophylla* visits the colonies of the bug on Jak. Not recorded before from India and no description of the species has yet been published.

25. *Phenacoccus insolitus,* Green.*

A mealy bug found doing damage to Brinjal plants all over South India. Generally found appearing on plants which are fairly old and have been in the field for a pretty long time. Attacked plants show the leaves covered

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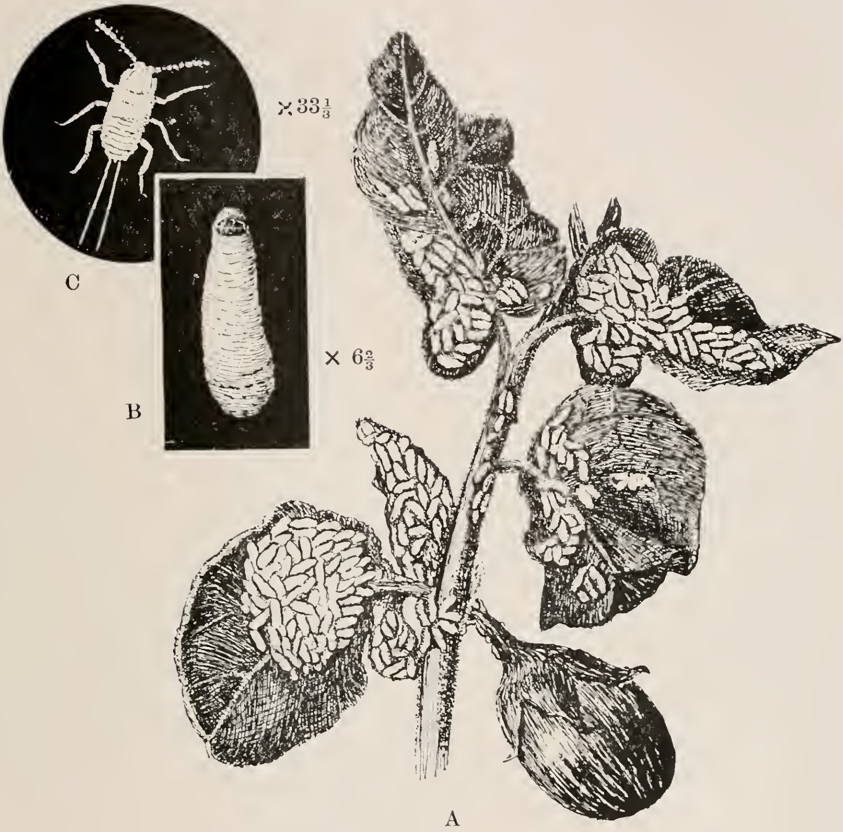
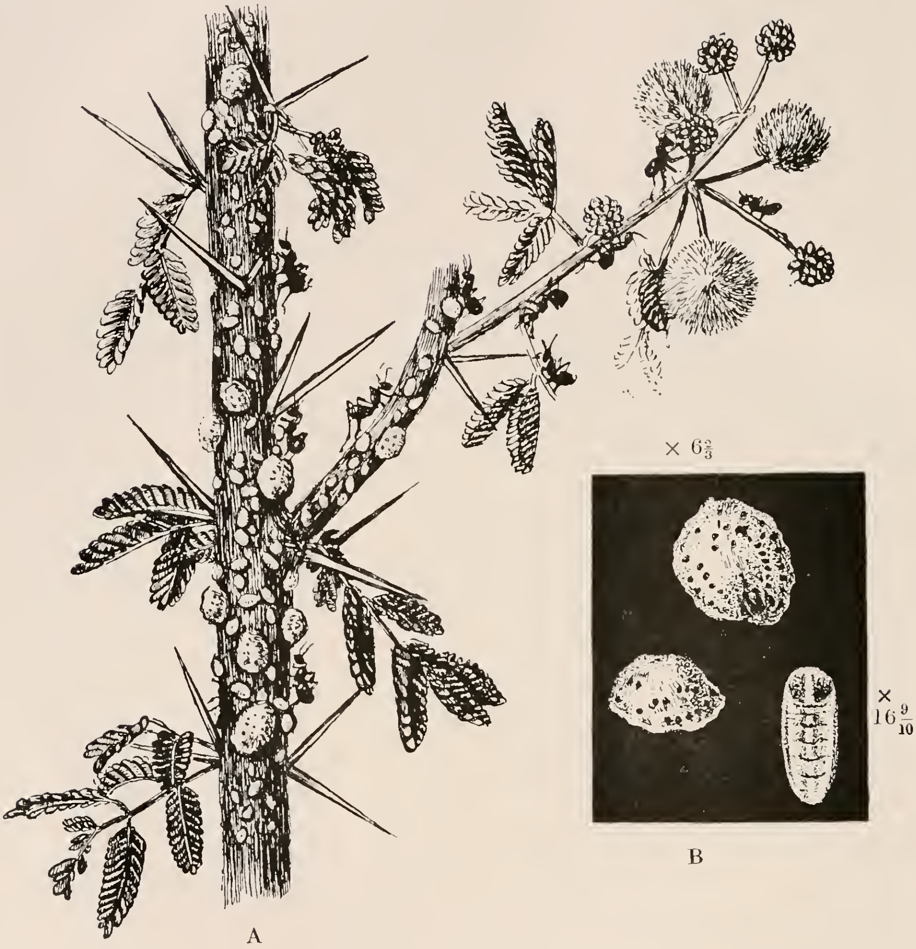
† Named by Prof. Newstead.



Phenacoccus insolitus, Gr.

A.—Brinjal plant covered with ovisacs.
B.—A mealy bug with ovisac magnified.
C.—The larva.



Anomalococcus indicus (nov. sp.) Green.

A.—Babul branch infested with scales and visited by the black ant.

B.—Female and male puparia magnified, two views of the former are shown (magnified.)

over by white patches, containing colonies of this mealy bug. It has not been found to attack any other cultivated plant so far; but it is pretty bad on brinjal. Recorded before on *Sida cordifolia* in North India.

26. *Phenacoccus iceryoides*, Green.*

A mealy bug found infesting citrus shoots (in Godavari), mango fruits and stalks (in Viziagapatam), and on shoots of *Odina odiar* tree in Coimbatore. Noted before on *Boswellia*, *Capparis* and mango elsewhere. This is also a somewhat destructive species found in white masses on the shoots and fruits of the host plants.

27. *Ripersia sacchari*, Green.*

This is an important mealy bug pest of sugarcane and often does serious damage. The orange coloured bugs are found clustered at the nodes of lower regions of the growing sugarcane plant which are covered over by the old leaf sheaths. The bugs are covered over with white powdery matter. Found on certain varieties of cane on the Coimbatore farm.

Sub-family—ASTEROLECANIINÆ.

28. *Anomalococcus indicus* sp. new. Green.*

This is a serious specific pest of *Acacia arabica* (Babul) in the Coimbatore district. The female scales are pale white in colour and spherical in shape. Young trees suffer badly from this pest and badly infested trees show the white scales in numbers on every portion of its stem, branches and shoots. A moth *'Eublemma scitula'* is found predacious on the scale and among the scales on the branches can be found the cocoons of this caterpillar which appear as dark brown spherical shell like objects bigger than the scales. Large colonies of the black ant *Camponotus compressus* are found nesting at the foot of the trees and visiting the infested branches frequently. The insect is a species new to science.

29. *Cerococcus hibisci*, Green.†

The scales of this species are spherical and is often found in yellowish or greyish brown masses on the shoots of cotton in different places. Not a serious pest. Noted on cotton in Vizag, Godaveri, Coimbatore and Tinnevelly districts. First described by Green in Vol. II of the memoirs of the Department of Agriculture, India. p. 19 (1908).

TACHARDIINÆ.

30. *Tachardia lacca*, Kerr.‡

This is the lac insect and produces the waxy secretion which forms the chief constituent of the shellac of commerce. This insect, therefore, is a useful one. Lac cultivation though well known in the Central Provinces and Bengal is not carried on anywhere in South India although *there is no doubt* that it can be successfully carried on in these parts also. In the wild condition I have found encrustations of this insect on Mango (Sadiapet), *Dalbergia lanceolaria* (Walayar forests), and on the Rain tree (in Coimbatore). It has been noted on a species of *Shorea* in Mysore and other places of South India. In Northern India of course it is found and cultivated on a variety of trees such as Kusum, Palas, *Acacia*, *Ficus*, *Zizyphus*, Red gram, etc.

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† Named by Prof. Newstead.

‡ The lac found on Dalbergia was determined as '*T. lacca, kerr*' by Mr. Green. One species I found on 'Thespesia' in Cuddappah has been determined by Mr. Green as '*T. lobata, Gr.*'

Sub-family—MONOPHLEBINÆ.

31. *Monophlebus tamarindus*, Green.*

This species of Monophlebus is noted infesting garden crotons in the Godavari District. The adult insects are stout and muscular and covered over with a white powdery bloom; they are able to move about.

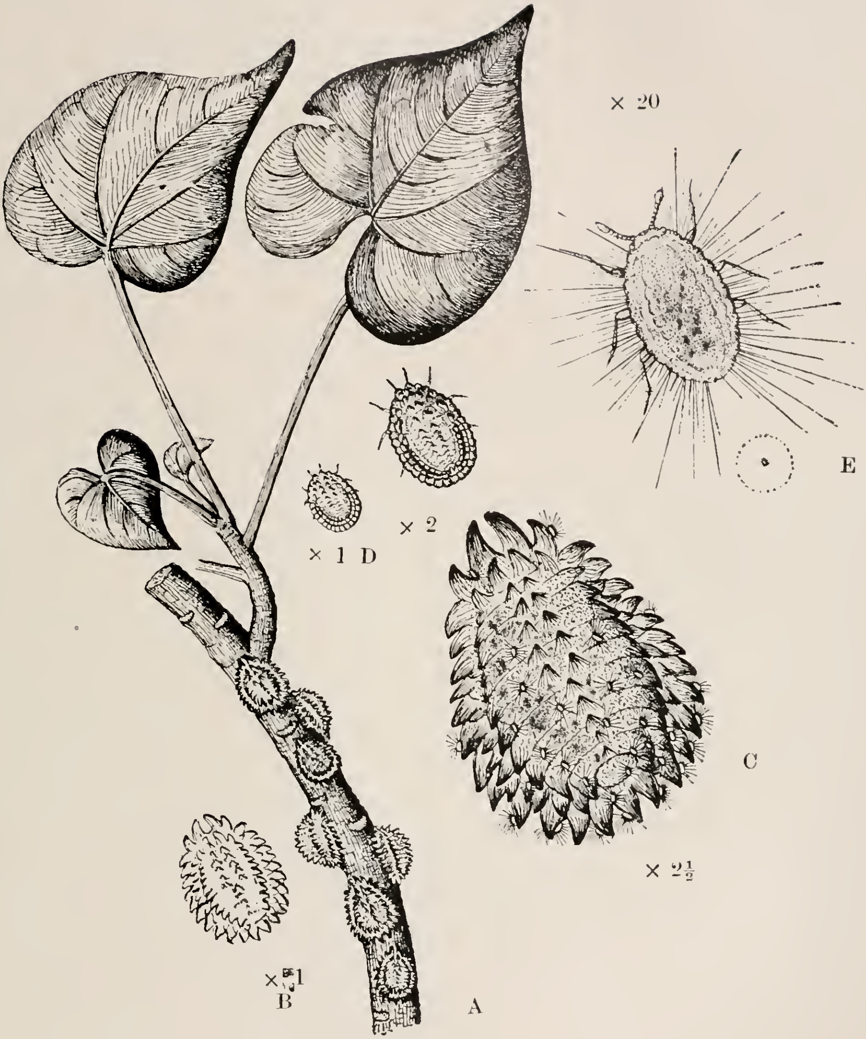
There are other species of *Monophlebus* recorded to do damage to mango, ficus, and other trees in North India.

32. *Walkeriana cinerea*, Green*.

The individuals of this genus are pretty large in size and have numerous waxy wart like projections from the body surface. I found this species bad on *Lawsonia alba* and Sandal-wood tree in South Malabar. The infested shoots which are covered with numerous individuals of this insect become pale and covered over with a sooty mould. I have recently noted this pretty bad on *Thespesia populnea* in Coimbatore. The branches covered by the scales turn sooty black and sickly.

33. *Icerya aegyptiaca*, Dougl.

This is one of the common mealy bugs found on all sorts of ornamental plants in gardens. The adult insects are covered with white waxy material and there are processes of the same material at the sides of the body; they move about slowly on the plant surface and are often found in colonies on the tender parts of the host plants. Has been noted also on Bread fruit tree *Artocarpus incisa* (South Malabar) on Jak (Nilgiris), and on *Ficus* leaves (Vizagapatam District).



WALKERIANA CINERIA, Gr.

A.—Adult scales on Portia stem X 1.
B.—Adult ♀.
C.—Adult ♀.
D.—Larvae, nat. and magnified.
E.—Very young larva magnified.

THE BIRDS OF PREY OF THE PUNJAB

BY

C. H. Donald, F.Z.S.

Part II.

(*With Plates I and II.*)

(*Continued from page* 265 *of Volume XXVI.*)

Types D & E.

This chapter deals with the True Eagles, the Hawk-Eagles and the Himalayan Rough-legged Buzzard, in all 5 genera comprising 11 species.

Type D takes into account all birds with a feathered tarsus. with the exception of the Lammergeyer which has been placed in a Type (C) by itself, on account of its beard, a characteristic which it shares with no other species of the Raptores.

Type E contains but one genus, and that genus is represented by only one species, so far as India is concerned, and even that is very rare. I place this bird (the Himalayan Rough-legged Buzzard) in a type next to the Eagles because its tarsi are feathered, in front, right down to the toes and I separate it from them because the Eagles and Hawk-Eagles have their tarsi feathered back and front whereas the Himalayan Rough-legged Buzzard has its feathered in front only, and naked behind.

Of the 11 species 3 are winter migrants and 5 are more or less restricted to the Himalayan forests and not likely to be met with in the plains, though all eleven are to be found in the Punjab.

Perhaps the least well known of all the Order of Acciptres are to be found among the larger Raptores. The ordinary man who has to spend a certain number of years of his life in India, and whose one thought is to get out of it as soon as possible, and whose interests do not lie in the direction of the fauna of the country, does not worry much about nomenclature and to him every bird he sees, provided it is a big one, is either a vulture or an eagle, and it does not much matter which. Our friend the Punjabi villager does not help us either, for though he knows the difference between the vulture and the eagle he calls them indiscriminately, "Ill" or "Illur", and by the time the seeker after knowledge has heard "Ill" or "Illur" applied to some 4 or 5 different species, which he has not had much trouble in identifying as being different to each other, whatever they actually are, he has come to the conclusion that there is a paucity of names in the Punjabi dialect, or that all big birds one sees are one and the same in different guises. The Sahib who calls everything a vulture or an eagle takes the place of the old Punjabi among the European community and soon damps the ardour of many a promising young naturalist newly arrived in the country.

It seems a pity that our English nomenclature is not more helpful either. It is distinctly puzzling to the student who has acquired the knowledge that all true Eagles and Hawk-Eagles can be recognised at a glance by their feathered tarsi, to suddenly come upon "Short toed Eagles", "Serpent Eagles" and even "Buzzard Eagles" which not only have a naked tarsus, but as in the last case have not even the size or presence to carry off the name; the White-eyed Buzzard Eagle being about the size of a crow. However, we are not here to discuss nomenclature, and these papers are written with a view to simplify identification.

There is a vast difference between the Vultures and the Eagles, even far up in the sky, and it takes very little practice to recognise one from the other. The flight of the Eagle is always a good deal "lighter" than that of the Vulture and the tail extends a little further beyond the line of the wings, than does that of a Vulture. The wings too appear to be narrower for their length, and even when soaring will often be seen to bend slightly from the tips.

At close quarters the feathered head separates the Eagle from the Vulture and the completely feathered tarsi, back and front, from all other diurnal birds of prey. Some of the Owls too have feathered tarsi, but there can be no confusion between an Owl and an Eagle.

Plumage is a most variable factor and unless it is possible to describe each and every phase of plumage minutely, it is extremely difficult to recognise a bird by the description of its plumage alone. In these papers I have taken the descriptions from the Fauna of British India and in many cases from Hume's "Rough Notes," as they cannot well be improved upon, but have not given them very fully. Since other factors are given which are much safer to rely upon than the plumage, the latter has only been touched on in a general way.

KEY TO THE TYPES.

Type.	*Size.*	*Characteristics.*
D.	Medium to large.	Head and neck fully feathered; tarsus feathered *back* and *front* to the division of the toes or very nearly.
E.	Medium ..	Head and neck fully feathered; tarsus feathered *in front only*, to the base of the toes, *naked behind.*

KEY TO THE SPECIES.

Type.	*Name.*	*Characteristics.*
D.	*Aqula chrysaëtus*, The Golden Eagle.	a. Primaries exceeding secondaries by more than length of tarsus; b. claws much curved, hind claw longest; c. primaries in closed wing reaching to within an inch or so of tail; d. *Nostril elliptical, higher than broad;* e. tarsus 4″ in length; f. hind claw without toe *over* 2½″.

Type.	*Name.*	*Characteristics.*
D.	*Aquila heliaca,* The Imperial Eagle.	a, b, c and d, as for *chrysaëtus*; e. tarsus 3½ to 3¾″; f. hind claw without toe *under* 2½″.
,,	*Aquila bifasciata,* The Steppe Eagle.	a, b, c and d, as for above; e. tarsus 4″; hind-claw without toe under 2″.
,,	*Aquila vindhiana,* The Tawny Eagle.	a, b, c and d, as for above; e. tarsus 3¼″ or under.
,,	*Aquila maculata,* The Large Spotted Eagle.	a, b and c, as for above; d. *nostril round*; *e.* tarsus 4″.
,,	*Hieraëtus fasciatus,* The Bonelli's Eagle.	a and b as for above; c. primaries in closed wing falling short of tip of tail by over 2″; e. tarsus 3¾ to 4″; g. wing 19″ and over.
,,	*Hieraëtus pennatus,* The Booted Eagle.	a, b and c, as for *Aquila*; e. tarsus 2½ to 2¾″; g. wing 14 to 16½″.
,,	*Ictinaëtus malayensis,* The Black Eagle.	a. as for Aquila; b. claws but little curved, inner as long as, or longer than hind; c. primaries in closed wing reaching to end of tail.
,,	*Spizaëtus limnaëtus,* The Changeable Hawk-Eagle.	a. Primaries exceeding the secondaries by less than length of tarsus; b. as for *Aquila*; c. primaries in closed wing falling very far short of tip of tail; h. feathering of tarsus not extending to division of toes; i. crest rudimentary.
,,	*Spizaëtus nepalensis,* The Hodgson's Hawk Eagle.	a, b and c as in *S. limnaëtus*; h. feathering on tarsus extends to division of toes; i. a crest always present.
E.	*Archibuteo hemiptilopus,* The Himalayan Rough-legged Buzzard.	As for TYPE. Tarsus feathered in front to the toes, naked behind.

TYPE D.

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus *Aquila* (5 species).

No. 1200. *Aquila chrysaëtus,* The Golden Eagle.

Characteristics. Size large; tarsi fully feathered to the toes; claws much curved, hind claw from 2¾″ to 3½″ round the curve, without toe; tarsus 4″.

Colouration. In adults, the head is dark brown paling to rufous tawny on the nape and sides of neck. The feathers of the nape and hind neck are long and lanceolate. Feathers in front of the eye are greyish white. The upper tail coverts, the small feathers on the bend of the wing, and the thigh coverts and under tail coverts are a light rufous brown, the tail coverts more faded than the thigh. The bases of most of the back feathers and quills are white, more or less mottled with dark brown. The rest of the plumage is a deep chocolate brown, almost black, with faint bars or mottling on the tail.

The young bird is a glossy brownish black throughout, except for the head and neck, which are marked like the old bird, but more tawny.

The secondaries are white for about half their length, making a conspicuous patch in the centre of each wing, when the bird flies, and the tail is white, finely mottled, for about two-thirds of its length. The tail coverts, bend of wing and flanks similar to that in old birds. Bill dark horny, tip black; irides hazal brown; cere and feet bright yellow.

Measurements. Length from 35″ to 40″; tail 13″ to 14″; wing 25″ to $27\frac{1}{2}$″; tarsus 4″; hind claw $2\frac{3}{4}$″ to $3\frac{1}{2}$″; expanse about 7 ft.

Habits, etc. The Golden Eagle is probably the least well known of all eagles, since it seldom, one might almost say never, visits the vicinity of even a hill station, except perhaps in the depths of winter, and then even rarely. It is, however, by no means so uncommon as people imagine, among the inner ranges of the Himalaya, and most of the big nallahs can boast of a pair of these fine birds. In his "Rough Notes" Mr. Hume says: "As far as I yet know, this bird is of such excessive rarity in the Himalayas, south of the snows, as scarcely to deserve a place in our list."

He says again, "every so called Golden Eagle which has, as yet, been sent me, has proved to be "*A. imperialis* in the dark third stage of plumage."

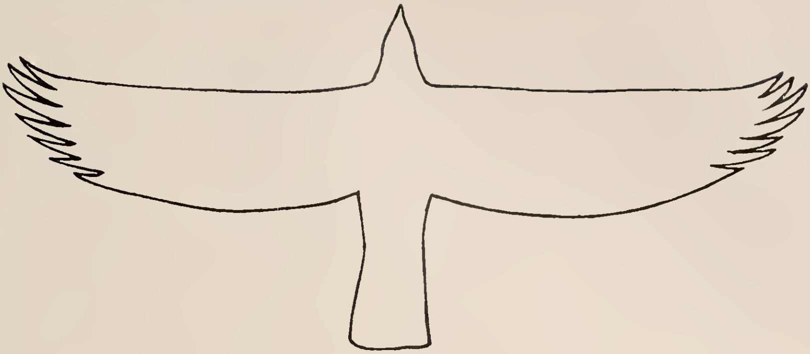
Mr. Hume had, at Kotgarh (in the Simla District), "a regular establishment for shooting and preserving birds", from whom he received over a thousand birds, and who had special injunctions to shoot all large eagles. From them he received several Imperial Eagles but not one single Golden, and though he quotes Dr. Stolickza as saying, this species "is often seen about Kotgarh and further east", he is obviously sceptical. Why this should be I cannot think, unless Mr. Hume has himself gone off the rails and mistaken the Golden for an Imperial yet this seems hard to believe in a man who so closely observed birds in the field. I have never seen the bird actually in Kotgarh, but have found him more than once near Narkandah, and have taken a nest within four miles of Baghi, on the upper Hindustan Thibet Road. The nest contained a single youngster which I took and reared. Further East, I found a nest in the cliffs near Moonsh within 6 miles of Daranghatti, also on the H. T. Road. Another nest also with a half fledged youngster, was taken by me at Shoang, a few miles S. E. of Kilba, and I can safely say, that the Golden Eagle is to be met with right along the Sutlej watershed, from Kotgarh to the Kailas Range, in suitable localities. I have again seen the bird in various parts of Kashmir and Chamba, and sent several specimens to the Bombay Natural History Society from Kashmir. Further to the East again, I have met with the bird in the Jubal and Taroche State of the Simla District, and in Tehri Gurhwal, as far up as Hursil within 2 marches of Gungotrie.

THE BIRDS OF PREY OF THE PUNJAB.

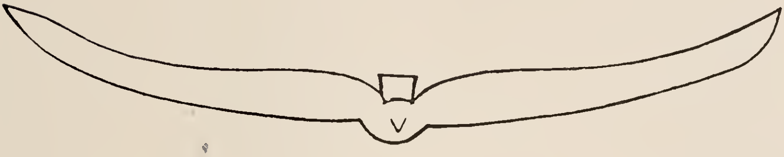
Explanation of Plate I.

Figs. 1 & 2 represent a bird flying directly overhead.
Figs. 1a & 2a ,, ,, ,, approaching on a very slightly lower plane.

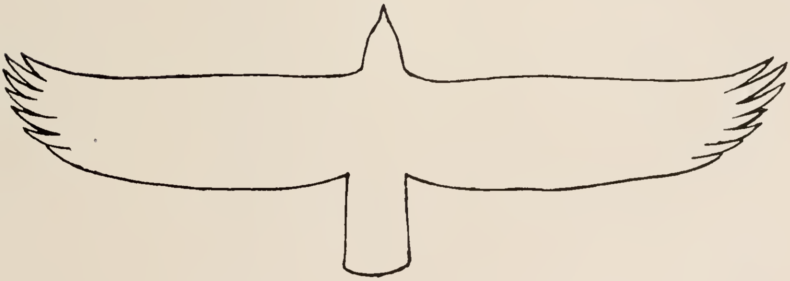
Figs. 1. & 1a Characteristics.	Wings fairly long, and curving upwards, and sometimes backwards, from the body. The fore-part of the wing forms an even and regular line from the body to the tip of the primaries, whereas the hinder portion, *i.e.*, the tips of the wing feathers come round in a slight curve, downwards from the primaries to about the centre and then slightly upwards. Where the tertiaries meet the body there is a regular triangle of light. The tail is long and protrudes well beyond the point where the tertiaries meet the body.
Characteristics applicable to:—	*Aquila chrysaëtus*, *Hieraëtus fasciatus*, *Ictinaëtus malayensis* and *Circaëtus gallicus*. The Black Vulture (*Otogyps calvus*), all the species of *Spizaëtu* and *Spilornis cheela*, are given to soaring with their wings held in a higher plane than is the body, as depicted in Fig. 1a, but the shape of the wings is different to the above, in either case.
Figs. 2 & 2a Characteristics.	Wings long and held on the same plane as is the body, except the primaries which may curve upwards near the extreme tips. The fore-part of the wing frequently uneven and the back, where the tertiaries meet the body, curve inwards less than in the preceding Fig. and make less of a triangle. Tail apparently shorter and protruding much less than in the above. The tail is often spread out like a fan in which case it appears shorter still.
Characteristics applicable to:—	All the species of *Aquila*, except *A. chrysaëtus*, the Fish Eagles (*Haliaëtus*) *Haliastur*, and to some extent *Buteo*.



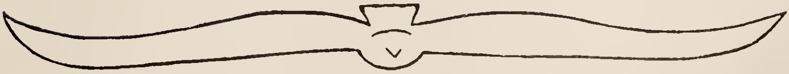
1.



1a.



2.



2a.

THE BIRDS OF PREY OF THE PUNJAB.

There is a world of difference between the Golden Eagle and the Imperial, and though the adult plumage of the Imperial very closely resembles the Golden, their flight is as the poles apart, and in the hand, the claws of the latter alone are sufficient to set him apart from every other bird of prey. The extraordinary part of it, to me, is that Mr. Hume should have collected so many Imperials from the hills around Kotgarh, as they are very uncommon and only to be found in the spring and autumn during their migrations to and from India. The Imperial Eagles are said to breed in the Himalayas, but I cannot remember ever having even seen one in any portion of the Himalayas, except as I have already stated, in the spring and autumn. Col. Ward was of the same opinion, and in a letter to me said, in over 20 years his collectors had never found a Golden Eagle, in Kashmir. This proves to me conclusively that the Golden Eagle is taken for the Imperial more often than one imagines. It might be said that the mistake is mine, and I have taken the Imperial for the Golden, but the specimens now in the Bombay Natural History Society's museum, sent by me some years ago, will prove that this is not so. I have reared 4 Golden Eagles, taken from the nest, and in each case the first plumage was the usual dark brown, almost black, with the head and other markings as given above. This would be the third or fourth year markings of the Imperial, which is a more or less light brown throughout in its lineated or first plumage.

The flight of the Golden Eagle somewhat resembles the Bonelli's eagle and also the Black Vulture, when soaring, except that he holds his wings even further back than either of them.

The wings curve backward from his body, to a slight degree, and very considerably upwards and the tips of the primaries appear to be several inches above the level of the body. The flight is light, graceful and bold, and the tail protrudes well back from the line of the tertiary quills. The only bird that the Golden Eagle can actually be mistaken for on the wing, is the Black Eagle, which has a very similar flight, and at some distance looks very much alike in colouring, but the Black Eagle is very rare in the haunts of the Golden Eagle, and the flight though very similar, is lighter than that of the latter. The Black Eagle has a tremendous expanse of wing in proportion to the size of his body and weight.

A. chrysaëtus has long been considered an enemy to game and to be destroyed, as "vermin," on sight, but the sooner this fallacy is dispelled the better will it be for both the Eagle and the game.

I do not mean to infer that he does not kill game, but what I do mean to point out, is, that he does more good than harm in destroying other vermin. The pair begin their preparations for the nest about March or early April and from this time on, they seldom visit the Alpine pastures, until the youngster leaves the nest and is able to accompany the parents, which is not until the end of August or beginning of September. Now, the Golden Eagle is essentially a falcon in his mode of hunting, and kills his quarry in the open. His great spread of wing is all against his hunting amongst trees. This fact is a safe guard to all the pheasants during the breeding season. The Snow Cock and the Monal who feed a good deal in the open, are safe from him from April to September, and the Kalij is safe because he seldom ventures far into open ground. The Koklass, on the other hand has the pace to get clean away from the eagle. I have flushed Koklass on many occasions at the edge of a deep nallah when an eagle appeared in view, and though I have seen some good chases, the Koklass has always got clear away. The environments of a Golden Eagle's nest gives one a very good idea of his depredations, during the time the youngster is in the nest. Crow's beaks and feet predominate to a very large extent ; next, in order, comes the Large Red Flying Squirrel (*Pteromys inornatus*). judging from the bits of fur and tails which strew the ground below. A village cat or two, and on one occasion, I found the remains of a fox and on another, the skull and tail of a fairly recently killed pine marten. Out of the nest from which I took the young one near Baghi, were taken a few feathers and bits of a freshly killed pheasant, and that a Koklass, so they do occasionally fall victims, but when one considers the harm done to game, Chikor in particular, by the Jungle Crow (*C. macrohynchus*), anything which tends to reduce their numbers with the regularity of the Golden Eagle, might well be allowed some latitude on his own account, and still have the balance well to his credit.

Shepherds all over the higher Himalayas tell of Golden Eagles carrying off young lambs, and I have myself seen a pair attack a musk-deer, which just escaped by running into some dense cover. Near Gungotrie, in the Tehri Gurhwal State, I saw one attack a full grown Tahr, and though I did not actually see the animal being struck, I saw it flying through space over a thousand feet of cliff, to be badly smashed up among the rocks below. As it landed within a few hundred feet of me, I went and examined it, and found a clean cut extending from behind the ear to half-way down the neck, evidently the mark of the formidable hind talon of the eagle. Two eagles circled over us the whole time. Though cases of their killing very small lambs and kids may not be very uncommon, I should think it is very seldom that they attack full grown Tahr, and, in this case, they must have either been very hard pressed for food, or came upon a sick or wounded animal.

Blanford mentions that this eagle lives on "gallinaceous birds, and on mammals, such as hares, lambs, kids, fawns, etc., and it is said occasionally to attack even wolves, but it does not disdain carrion".

I have never seen this bird approach carrion. I have watched many times vultures on a carcase and have seen a pair of these eagles circle overhead, as if to make certain there was nothing there for them to catch, but I have never seen one come down.

One spring, 1903 I think, Buffalo-herds lost a number of their animals whilst crossing the Chuttar Dhar into Bhadarwa (Kashmir), due to an unusually heavy fall of snow, while they were crossing, and vultures feasted daily on the pass, but I never saw a Golden Eagle among them at any time, though a pair might any day be found in an adjoining "nallah". Again, I fear a case of mistaken identity, and the Imperial the real culprit.

The young Golden Eagle is hard to mistake, on account of the large white wing patch, and the white bar on the tail, both being visible almost as far as the bird itself can be seen, on the wing.

It is said to lay usually two eggs, occasionally white: more often blotched with rufous brown, measuring about 2·87 by 2·25.

The nest is a huge platform of sticks, usually on a ledge in a cliff, lined with branches, with leaves adhering to them, grass and lichen.

Since writing the above, I have received the following extract from Hume's "Nests and Eggs," Vol. III, pp. 130-131, from Mr. A. E. Jones of Simla (to whom I am greatly indebted for various bits of information with regard to the Raptores), and which I had not seen previously. I quote the above in full. Mr. Hume had evidently had reason to change his opinions since he wrote his "Rough Notes".

"The Golden Eagle occurs and breeds sparingly in the Himalayas from Sikhim to Afghanistan; in the eastern and central portion of this tract it is confined to the immediate neighbourhood of the Snowy Range, but in the extreme N. W. it comes nearer down towards the plains. Mr. Frederic Wilson, well known as "Mountaineer," writing of the country about Gungootire and Jumnotrie, tells me that it inhabits the hills jutting out from the Snowy Ranges, and often soars over the latter and up their remote valleys. It is never seen on the lower ranges. It does not go into the dense forests, but may be seen sailing above them and along hill sides that are entirely bare, or only studded with a few trees, here and there. A pair are generally seen together. They feed on pigeons, monals and more especially on the Snow Pheasants, on the young of Tahr and Bhurrel, and will kill adult Musk-Deer. I have several times seen them do this.

"The nest I have not seen except on a precipice which was quite inaccessible.

On the other hand, at Thandiani, a hill some 9,000 ft. high, overlooking the Agrore Valley, on the borders of Hazara, Captain Unwin found a nest and secured a young one thence, along with the female bird, which he sent to me. He says: 'The nest was placed on a Deodar tree overhanging a steep precipice. It was about 25 ft. high from the ground, and was composed of a vast number of sticks and branches, collected from the neighbouring Pine trees. These were piled up against the trunk of the tree to a height of about 6 feet, and formed a platform of almost 3 ft. in width; it was lined or littered with dry grass and roots. Some Goojars, who live near the steep ravine, where we found the nest stated that this pair of Eagles had bred, in this same nest, for the past three years, and that they occasionally carried off lambs and kids from their huts.' "

In Kulu and Gungotrie I have heard the Golden Eagle called "Mariari" and east of Simla, in Bushahr, it is known as "Dhungshoorish" which means the "monal tiger" or monal killer.

TYPE D.

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus *Aquila*.

No. 1201, *Aquila heliaca*. The Imperial Eagle.

Characteristics. Size very large; nostril eliptical, higher than broad; tarsus under 4″ (3·4 to 3·8); hind claw without toe, round curve, 2″ or under.

Colouration. Head and neck varying from tawny buff to almost pure white in certain specimens. Dark streaks to feathers of forehead and back of the head. The feathers on the neck generally black shafted.

With the exception of the above and the wing coverts near the bend of the wing, upper and lower tail coverts, and the tip of the tail feathers, which vary from buff to a whity brown, the whole bird is a deep blackish brown throughout, highly glossed. The basal portion of the tail mottled, forming a sort of irregular grey-brown band across the tail. There are generally a few pure white, or white with irregular dots of black or dark brown, feathers on the back and scapulars, indiscriminately scattered about.

The young or lineated plumage of the Imperial Eagle is very different, being:—

Head and nape brown, the feathers with paler edges. The upper back, wing coverts and scapulars are a darker brown, with pale centres, tips or edges. The lower portion of the back is a very light brown or buff, and the upper tail coverts are white with a slight tinge of reddish.

Tail light brown with fulvous tips, mottled towards the base, forming paler bars. The primary quills are a very deep brown and the secondaries and tertiaris are paler, more or less tipped with whitish and somewhat mottled.

The whole lower parts of the bird are a pale brown, each feather with a darker border, this border being thin on the throat and upper breast and very pronounced lower down. The thigh plumes, vent and lower tail coverts are a dirty browny white. Bill bluish horny; cere yellow, with a greenish tinge; irides light to dark brown; feet whitish yellow.

Measurements. Length 28 to 32″, wing 22″, tail 11½″, tarsus 3·7; expanse about 6 ft.

Distribution. Throughout the Province in the winter.

Habits, etc. The Imperial Eagle is said to build freely in the plains of India and in the Himalayas, though it is generally said to be only a winter visitor to this country. Mr. Hume found them breeding in the upper Punjab and Mr. Blewitt took a nest in Hansi, which undoubtedly was that of the Imperial Eagle as the female, an adult in the dark plumage, was shot on the nest.

For a long time the next species *A. bifasciata,* was considered a phase of this eagle, until Messrs. Brooks and Anderson separated them as different species. Mr. Hume divided the plumage of the Imperial Eagle into four phases, *viz.* the first or lineated stage; the second with the pale bars on the wing (the typical Steppe Eagle) the third or dark brown phase without the wing bars probably the second stage of the Imperial, and the fourth or last stage where the eagle assumes its adult dark plumage, with a light head and neck.

In considering the third stage, *i. e.*, with the conspicuous wing bars, as a phase of the Imperial Eagle, possibly in its second year, it is strange that Mr. Hume did not take into consideration the numbers of birds in this plumage in proportion to the numbers he saw in each of the other stages. Had he done so, he must have realised that it could not be the same species as the Imperial Eagle, unless he was prepared to admit that this phase of plumage, once assumed, remained for some years. If, as he considered, the adult plumage of the Imperial Eagle was assumed in its third or fourth year, it would stand to reason that there would be many more birds in the adult plumage than in any immature one, which was merely a phase of a single season. Yet the Steppe Eagle, *i. e.*, Hume's second phase of the Imperial, is infinitely commoner than the dark Imperial, and for every one that is met with of the latter, 10 might be counted of the former.

However, they have since been separated and the point is at rest but the fact that they were once considered the same bird nullifies the value of much of Mr. Hume's information with regard to this species. For instance he recounts Mr. Hutton's account of the arrival of these birds near Mussoorie. "In October we have sometimes seen as many as fifty together, sailing leisurely in a wide-spread flock, if such it can be called, and coming from the West leaving individuals at intervals along the line of march. These appear to be all in the plumage of *A. bifasciata*, and judging from the few adults procurable here, they may almost be called rare."

Now if *A. heliaca* and *A. bifasciata* were one and the same bird, there would be justification in calling the Imperial Eagle one of our commonest birds, in the winter at all events, which it is far from being. Of course, Mr. Hume himself was not sure that they were all phases of one and the same bird, but in the absence of conclusive proof, he assumed that they were and hence we have the habits of two species rather mixed up, and in recording the finding of nests in the upper Punjab, without describing in particular to which phase the nest belonged, it leaves one wondering whether by any chance, the nest of *A. bifasciata* has been found in India after all.

In over 20 years spent in the Himalayas I have never once seen this bird after about May, or before September, and unless some authentic case is recorded of its doing so, will remain very sceptical about its breeding in the hills, even though stragglers may remain to do so in the plains.

In my notes on the Golden Eagle, I have mentioned that the Imperial and the Golden are evidently frequently taken one for the other, and the Golden has obviously been accredited with the ignoble habits of the Imperial, and the Imperial received the name for being a hunter, which he never earned due to his likeness to his noble cousin.

In the full adult plumage, the head of the Imperial is very much lighter than that of a Golden at any stage. His flight too is that of a vulture, slow and heavy, with wings spread in a straight line with the body. The tail too is shorter, or rather protrudes, less than that of the Golden. The wings appear to be broader.

The Imperial is quite content to sit on a stump or the top of a tree in an open plain, by the hour, and wait until some rat or lizard, or frog makes its appearance, or some smaller and weaker bird of prey than himself has the temerity to kill something within the range of his keen vision. Under these circumstances the Imperial bestirs himself. I have seen him in full pursuit of a hare but I should not think he often succeeds in catching one.

As a robber he excels, as with the exception of Pallas's Fish Eagle, he is "top dog" in the plains, most birds have to give up their spoils when the Imperial arrives on the scene.

The Imperial can easily be identified from the Golden by his much shorter hind claw and tarsus, and a young Imperial in the lineated plumage, from the Steppe or the tawny, both by the length of tarsus and the dark edged feathers with paler centres, which gives a streaky appearance, on the breast and abdomen, which is lacking in the others.

Like most of the true eagles, except the Golden, he lives a great deal on carrion and is a constant attendant on slaughter houses.

The nest is said to be the usual platform of sticks placed on a tree. Usually two eggs are laid, unspotted greyish white or pure white, measuring 3 by 2·2. Indian examples 2·7 by 2·09.

TYPE D.

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus *Aquila*.

No. 1202. *Aquila bifasciata*, The Steppe Eagle.

Characteristics. Nostril eliptical, higher than broad; tarsus 4″; hind claw without toe 2″.

Colouration. Very variable. In some specimens the whole bird is deep brown and in others a very light pale brown; often a rufous patch on the nape, which varies in size. The back, quills and tail very dark brownish-black, the latter with traces of greyish bands or cross bars.

Usually there are variations of the above, such as lighter coloured mottling on the quills, and buff tail coverts.

Younger birds are paler, some being very pale buff but more often a soft umber-brown, without the nape patch. There are almost always two whitish bars on the wing, faint in some, very distinct in others, due to the white tips to the secondaries and the greater wing coverts being pale tipped.

These bars are visible both above and below, as the under wing coverts are also pale tipped, and are a conspicuous feature of this bird.

The quills are more or less mottled and barred. In some the tail coverts are light buff whereas in others they are deep brown.

The tail is usually narrowly tipped with white or buff and the rest of the feathers either brown throughout (except the tip) or mottled grey, or white, and forming cross bars.

Bill and claws black; gape, cere and feet yellow; irides dark brown, sometimes lighter and very clear.

Measurements. Length 30 to 32″; tail 11½″; wing 22″; tarsus 4″.

Habits, etc. The Steppe Eagle is a cold weather visitor to India and during the winter one of the commonest of birds of prey, both in the hills and plains. Though the claw of this species is about the same size as that of the Imperial, the foot is smaller and weaker. Blanford says that the nest of this species has never been found in India, and is generally placed on the ground. I am inclined to think that stragglers do occasionally breed in this country, and I should not be surprised to find that the extraordinary variety of plumage, is due to its occasionally interbreeding with the Tawny Eagle. In the early spring of 1916 I found a Steppe Eagle carrying sticks to the nest of a Tawny Eagle from which I had only a few minutes previously caught a Tawny. Then again, a few years previously I shot a bird which, as far as colouring went, was a typical Tawny Eagle, on a high pass in Bushahr State, in October, when the usual migrants were coming in daily. This bird had not the smallest trace of the wing bars and was a uniform rich brown throughout. Its size corresponded with an average Tawny, as also other measurements with the exception of the tarsus which was 4″ like that of a Steppe Eagle. Then the fact of its appearance on a high pass just at a time when Steppe Eagles might be expected but a Tawny most unexpected. Was it merely an abnormal specimen of either the one or the other or was it a hybrid ? If so, do Steppe Eagles occasionally remain behind and mate with Tawny Eagles or do some adventuresome spirits among the Tawny accompany the Steppe Eagles to their summer haunts ?

In habits the Steppe resembles the Imperial but is more given to soaring and hunting for its food, instead of waiting for it to come to it, than is the latter. The flight is the usual slow heavy flight of the eagle with wings held in the same plane as the body. The tail of this species (and the next) protrudes only a very little more than does that of a vulture and when ringing, is frequently opened out like a fan, which makes it look shorter still.

The white bars are visible a long way off when the wings are fully stretched, and in some specimens, are quite distinguishable even when the bird is sitting. Occasionally almost a black specimen will be found sailing about in the company of other eagles or vultures, but some traces of the usual bars will separate it from the others, if it *is* a Steppe.

TYPE D.

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus *Aquila*.

No. 1203. *Aquila vindhina*, The Indian Tawny Eagle.

Characteristics. Nostril eliptical, higher than broad ; tarsus 3″ or under.

Colouration. Very variable. Varying from a deep rich umber-brown to an almost dirty buff. Sometimes the plumage is party-coloured, being deep brown and light grey brown, at others it is more or less uniform throughout.

The quills are dark brown or black at the end, with greyish marking and mottling towards the base. The tail is frequently barred and as often unbarred, almost uniform light brown.

To some extent these changes are due to age, but on the other hand, the first year plumage shows considerable variations and it is practically impossible to make any description of them intelligible, unless each phase is to be described separately and in detail.

Bill bluish grey, tip black; cere yellow; irides hazel-brown; feet yellow or dirty greenish yellow.

Measurements. Length 25″ to 28″; tail 10″ to 11″; wing 18″ to 20″; tarsus $2\frac{3}{4}$″ to 3″; expanse 5′ to 6′.

Distribution. Throughout the Province, not common in the higher Himalayas.

Habits, etc. This species is by far our commonest eagle and has the distinction of belonging purely to the Indian Empire. It breeds in the plains from November to June, on trees, very often on quite low bushes, and is said to lay usually 2 eggs, greyish white more or less spotted or blotched, measuring 2·63 by 2·11. It closely resembles the last species, in flight, colouration and habits, but lacks the white bars which are a feature of the Steppe Eagle. It lives to a large extent on garbage and on what it can rob from other birds of prey, notably the Common Pariah Kite, which frequently has to give up its dinner.

Great differences of opinion exist as to whether the light or the dark is the nestling or first plumage. Mr. Hume gives a very interesting account of the various stages of plumage in which this bird breeds, but unless a series of these birds had been reared from the nest, and kept until they had assumed their final adult plumage, I do not know how one can possibly arrive at what constitutes each phase. Mr. Hume, for instance, says: "The young one in the nest is yellowish white, and the young of the first year are little else but whity brown. In the second stage, early in the second year, they become wood-brown and in this stage are found breeding, although rarely". A specimen found in the nest by Mr. D. Dewar some years ago, near Lahore and given by him to the Lahore Zoo, was a very deep umber-brown throughout, the head, breast and underparts, except the vent which was lighter, being all exactly the same colour, unstreaked and unmarked in any way. Two youngsters found by me in Wazirabad, some years ago were both a good deal lighter than the one found by Mr. Dewar, but distinctly a uniform darkish brown and could by no means pass for "yellowish white" or *whity* brown.

Whether the variations in the nestling and first plumage are due to locality or to the season in which they hatch out, it is not easy to say, but that they do exist, and to an extraordinary degree, I do not think there can be the least doubt. If then it be admitted that they do exist, without keeping several birds and watching each successive phase, it would be practically impossible to state with any degree of certainty, which phase of plumage belongs to any particular age. Sometimes it is not difficult to tell whether a bird has undergone one or two moults, by the presence of the unmoulted feathers of a previous phase remaining; these are generally much frayed and faded.

Writing to me with regard to this species, Mr. A. E. Jones says:—

"As regards the various phases of plumage of *A. vindhiana* I quite agree with your remarks. If anything, I incline to the belief that the *fully* adult (a very old bird) is the bird in the palest plumage of all." ...."When a pair are breeding, more often than not, they are in entirely different phases of plumage. So taking all the evidence I think it is simply a case of "*Buteo vulgaris* over again. One thing I have noticed, up round Lahore way one sees many more pale specimens than dark ones. Round Amballa, where there is more scrub (dhak) jungle, the reverse is the case, in my experience."

The point raised by Mr. Jones, with regard to the scrub jungle, is interesting. I have not myself noticed that the plumage differs according to locality, to any marked degree, between one portion of the Province and another, but then again, I cannot say I have been on the look out for this peculiarity. If we accept this as a general characteristic and assume that the birds round Ambala are, as a general rule, darker than their up-country brethren, we must take it for granted that the species is localized very considerably and does not quit the locality in which it was born. If so, how far does environment effect colour?

It would be interesting to know whether any other members of the B. N. H. Society have noticed the same peculiarity and, if so, to what cause they ascribe it.

TYPE D.

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus *Aquila*.

No. 1205. *Aquila maculata*, The Large Spotted Eagle.

Characteristics. Nostril round; tarsus 4″; plumage soft.

Colouration. "Dark, almost blackish brown, with a slight purplish gloss on the mantle; primary quills black; tail unbarred, but washed with grey towards the end above; head and neck all round paler, the tips, and sometimes broad shaft-stripes to the lanceolate feathers of the crown and nape, lighter brown; feathers on tarsus and upper and lower tail coverts mixed with whitish; base of all feathers, including wing and tail feathers, white."

"Young birds are also dark brown and differ chiefly from the adults in having the upper back and smaller wing-coverts marked with elongate paler greyish-brown spots, these spots are largest and whitish on the smaller scapulars and median coverts; longer scapulars, larger coverts, and secondaries with large buff tips; lower back and rump pale brown, with dark edges to the feathers; upper tail coverts whitish; tail black, grey, or mottled towards the end and pale-tipped; lower plumage with light brown shaft-stripes varying in breadth and tint; vent and lower tail-coverts buff. Some birds are pale brown beneath." (Blanford.)

Bill greyish white with a tinge of blue, the tip dusky brown; claws blackish brown; feet dirty yellow with a slight tint of orange; irides light yellowish brown; cere and gape yellow.

Measurements. $25\frac{1}{2}''$ to $28''$ in length; wing $19''$ to $21''$; tail $10\frac{3}{4}''$ to $12''$; tarsus $3\cdot9$ to $4\cdot25''$; expanse $5'$ to $6'$.

Habits, etc. The Large Spotted Eagle is usually to be found in the vicinity of water. Dr. Blanford does not record it from the Punjab at all and Mr. Hume mentions having got specimens from Saharanpur but no place further North than that.

He also mentions how this eagle changed its locality with the change in the conditions of the country, making its appearance in the Etawah district where it used to be unknown, shortly after canal irrigation made the dry sandy tracts into moist cultivated areas, and swampy jheels, more suitable to the habits of this bird.

Thence it has worked its way gradually up into the Punjab and is now, by no means rare in the Gurdaspur District and I have met with it as far north as Wazirabad, in the Gujranwala district.

Whether it has always been in the Punjab and passed unnoticed I am unable to say, but it is quite possible it is more or less a recent arrival in the Province, *i.e.*, since canal irrigation became a general feature in what was once dry soil.

It is a sluggish bird, and not much given to soaring, though it may be seen at great heights occasionally. For the most part it lives on frogs, rats and such like and does not disdain even smaller fry still, as I shot one with a mole cricket between its mandibles.

A very dark bird, in the vicinity of a jheel, which has not got a white head, is pretty certain to be an adult Spotted Eagle.

The flight resembles the Tawny or any of the other eagles, *i.e.*, slow and heavy with the wings in line with the body.

This eagle breeds on trees in India, from April to June and is said to lay a single greyish-white egg, profusely spotted and blotched with yellowish brown, measuring about 2·65 by 1·98.

TYPE D.

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus *Hierœtus* (2 species).

No. 1207. *Hieraëtus fasciatus*, The Bonelli's Eagle.

Characteristics. Wings not reaching to within a couple of inches of tip of tail; primaries exceeding secondaries by more than length of tarsus; claws much curved, hind claw longest.

Colouration. In the adult plumage. Forehead and top of head a rich brown. The lores whitish. White streaks and spots visible on the head, being the bases of the feathers showing through. The back of the head show traces of white edges. The neck, behind, and upper back, scapulars, wing coverts a rich deep brown, the primaries and secondaries being almost black. The whole of the upper parts, including the rump and tail coverts are dark to very dark brown, with white bases of feathers showing through here and there. The actual shades of brown vary in individuals from a deep grey brown to pure brown or sometimes blackish brown, depending on age. Tail feathers are a dull grey brown, mottled with lighter grey and forming irregular bars. The central feathers as a rule pure brownish grey, unmottled.

The whole of the underparts, with the exception of the thighs, tarsi, under tail coverts, and wing lining pure white, with a narrow line of brown on either side of the shaft of each feather. The extent of these brown lines also depend on age, being broader on younger birds. The thigh coverts brown, indistinctly spotted with white and the tarsus irregularly intermixed with brown and white. Under tail coverts sandy brown, with whitish irregular bands. The wing lining brown but not so rich brown as on the back. and with spots and blotches of white, especially on the lower wing coverts.

Young birds vary greatly from the first to the adult plumage, being lighter on the upper parts and reddish brown beneath with darker shaft stripes and vary from a deep rufous buff to a light reddish brown.

Bill bluish grey, tipped black; cere and gape yellowish; irides pale brownish yellow, rarely bright yellow; feet pale dingy whitish brown with a yellowish tinge. (Hume.)

Dimensions. Length 26 to 29″; wing 19 to 20″; tail 10 to 12½″; tarsus 3½″ to 4″ ; expanse 5 to nearly 6 feet.

Distribution. Practically throughout the Province, but not ascending to very high altitudes.

The Bonelli's Eagle is one of the most sporting of the Eagles and though classed as a *Hawk*-Eagle, owing to the lightness of his build, and the characteristic common to the *Hawk*-Eagles of being partially white on the breast in some phase or other of its plumage, it resembles the True Eagles closely in its mode of hunting. If we take the Golden Eagle as the type of the True Eagles and the Spizæti as the type of the Hawk Eagles, the Bonelli's is much more of a True Eagle than a Hawk Eagle, except for the breast marking and lightness of build. The wings, though falling well short of the tip of the tail in the closed wing, are none the less a good deal longer than those of the Spizæti, and it is a typical falcon in its method of hunting in the open. Almost invariably they will be found hunting in pairs. The flight is very like that of a Golden Eagle; the wings are held well back, tail protruding considerably from the edge of the tertiaries, and the flight itself light, bold and graceful. The adult is unmistakable from the very light, silvery whiteness of the underparts, combined with the characteristic flight.

These birds do considerable damage among poultry and pigeons and the fact that they can take pigeons so easily, shows that they are gifted with considerable speed. On the hill sides they take toll from chikor to no small extent.

On page 145 of Vol. XV of the Journal of the Bombay Natural History Society Mr. W. D. Cumming gives an interesting account of the method of attack of these birds when depriving a hen of her chickens. He states that the birds sat down in front of the hen and then dashed in among the chickens, instead of swooping at them, but this I should think was rather the exception than the rule. I have, caught the species many times and with bait varying from a quail to a full grown fowl, and there has never been any hesitancy about the form of attack. A determined swoop right into the net which has often carried it several feet past the bait in spite of the Eagle being wrapped up in the net, which of course, it carried with it, by its impetus.

The Bonelli's Eagle is by no means rare and almost a certain find, if in quest of this bird, is a crow colony, late in the afternoon. In almost all the plains stations near one of the main rivers, will be found a grove of trees, which crows have selected for their roosting haunts, and will be found congregating there in their thousands, in the afternoon. Sooner or later one or more of these Eagles will make their way to the colony in quest of their dinner and seldom need go hungry thence. There need be no doubt as to when the Eagle arrives. Every other large bird of prey will be mobbed and driven away by the crows, but the excitement when the Bonelli's arrives cannot be mistaken. Every crow leaves the trees, and making a wide detour, comes round in the rear of the Eagle where might be found a mob some hundreds, if not thousands strong, keeping close behind it, but the sky in front is clear of them. The only other bird, which the crows show respect to is a Peregrine Falcon, and she is held in even greater dread, but one cannot be mistaken for the other, owing to the Peregrine being not much bigger than the crows themselves, whereas the Eagle is, of course, more than double the size.

This species, though a bold hunter in his wild state, appears to be practically useless for hawking purposes. I have never tried him myself but have heard from those who have, that he is most disappointing. Col. Biddulph, a well known falconer, and one of the best authorities on the subject, in the country, told me he had got one to stoop two or three times to the lure but no more.

Another well known falconer found his eagle would "take" almost anything, so long as the quarry had a string tied to its leg, or was in difficulties, but would not attempt to give chase after a wild bird. The eagle was eventually found useless and given its liberty. It, however, refused to go and the following morning returned and caught a duck in the next compound to that in which it had lived so long. The sweeper boy rushed out to save the duck but the eagle had its own ideas on the subject, and got his claws well home into the sweeper boy!

The Bonelli's breeds in cliffs as a rule, but does not disdain trees when no cliffs are available. The nest is the usual structure of sticks lined with grass or leaves. The eggs are white with a faint greenish tinge, sometimes unspotted and at others marked with brown blotches or streaks and measure 2·78 by 2·1 and are usually laid from December to February. (Blanford.)

TYPE D.

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus *Hieræetus*.

No. 1208. *Hieraëtus pennatus*, The Booted Eagle.

Characteristics. Size medium, length under 22″; tarsus $2\frac{1}{2}$ to $2\frac{3}{4}$″.

Colouration. There are two very distinct phases of plumage in this species, but as the bird is absolutely unmistakable from its size and by the length of its tarsi, it is not necessary to give the details of plumage. In the light phase the top of the head, nape, sides and back of neck are a pale buff with a rufescent tinge, each feather with a darker centre. Forehead and lores buffy white, a narrow blackish streak running between the eyes and the lores, and a similar streak both under and over. The whole of the upper plumage varies between a very pale buffy or rufous white to wood brown, darkest on the primaries, which are blackish, but the deeper shades of brown predominate on the upper surface generally.

The lower surface is much lighter being a buffy white, with dark streaks on the feathers, particularly on the chin and upper part of the breast. "Young birds have the head and neck rufous brown or dull rufous, sometimes dark brown. The upper plumage brown, as in adults but with dark shaft stripes; tail coverts whitish; lower parts either dark brown or pale rufous, with blackish streaks, except on the lower abdomen tail greyish brown above, paler below more or less distinctly banded and pale tipped." (Blanford.)

The dark or melanistic phase of plumage is somewhat similar to the young plumage above described. Whether the dark phase is retained for any number of years it is not known, but birds are known to breed in it.

Bill pale blue at base, blackish at tip; irides pale brown; cerc, gape and feet yellow.

Measurements. Length 19 to $21\frac{1}{2}$″; tail $8\frac{1}{2}$ to 9″; wing 15 to 16″; tarsus $2\frac{1}{2}$″.

Habits, etc. This species is said to be a winter visitor to India and Blanford only records one nest as having been taken and Hume says that nothing is known of its nidification in India. The bird is by no means rare and breeds freely in the higher Himalayas. I have found its nest in Bhadarwa (Kashmir), in Tehri Gurhwal and in Bushahr (Simla District). One pair built for

3 consecutive years on a very high deodar tree in front of the Forest Bungalow at Nachar, on the Hindustan-Tibet Road, and reared one youngster on each occasion.

They utilised the same nest each time—but evidently added to it every year as I watched them carrying sticks to it. On one occasion only have I seen birds in the dark plumage breeding and strangely enough both were in the same plumage. In every other case the parents have been in the light phase and the youngsters have been dark.

The flight is very kite-like and in the dark phase it might be very easily mistaken for a kite, except that the tail is never forked.

In the light phase the bird appears to be almost pure white below with black margins to the wings, like the White Scavenger Vulture.

When soaring the wings are frequently slightly bent, like a kite's and the flight is very light and wavering, frequently changing direction or swerving from its course, and the first joint of the wing is constantly being bent and straightened. This species lives chiefly on small birds and rodents but does not despise lizards and frogs.

It breeds in April and May and is said to lay two eggs, greenish white with generally, but few coloured markings. (Blanford.) A very noisy bird in the breeding season, with a shrill piercing call.

TYPE D.

FAMILY FALCONIDÆ.

SUBFAMILY FALCONINÆ.

Genus *Ictinœtus*.

No. 1210. *Ictinaëtus malayensis*, The Black Eagle.

Characteristics. Claws *not much* curved, inner equal to or longer than hind claw; primaries in closed wing reaching to end of tail; inner toe thicker than middle toe and nearly as long; outer toe very short.

Colouration. Almost black throughout; lores whitish; tail feathers with grey mottling above and whitish below; lower parts sometimes very deep brown.

Young birds appear to vary slightly with regard to the amount of, and the colour of, the marking on the head and under parts. On the whole the young only differ in being a little browner, in having a lighter coloured head and some marking on the lower parts. The extent and colour of this marking varies a good deal, probably with locality, but whatever be the marking the curious formation of the foot is a sure index to this species.

"Bill greenish horny, black at tip; cere, gape and feet bright yellow; irides dark brown. (Blanford.)

Measurements. Length 27″ to 31″; tail 13″ to 14″; wing 21½″ to 24″; tarsus 3½″; expanse about 6 feet.

Habits, etc. This is essentially a bird of the hills and not often to be met with in the plains. Blanford says that the eggs were obtained by Hume from Kulu and Bushahr, and were said to have been taken early in January, and Lt.-Col. Rattray records the finding of a nest in Changlagali on the 4th May 1904, with one egg, much incubated. (Journal of the Bombay Natural History Society, Vol. XVI, page 662.)

Blanford gives its distribution as "throughout the Himalayas as far west as Chamba———" but it is obvious it is to be found a good deal further west and north, judging from the finding of the nest in Changlagali. Though widely distributed, I do not think this bird is often met with anywhere in the Punjab. Personally I have only come across it about half a dozen times in over 20 years wanderings in the Himalayas, though I saw it frequently during 18 months I spent in the Jeypur Agency (Madras Presidency) and on the borders of the Bastar State (C.P.). The flight of this handsome eagle has been likened to that of a Harrier, but, though he resembles the Harriers in his manner of beating over a hill-side and suddenly checking, to drop silently into the grass, the flight itself is more like that of a Golden Eagle, the wings held well back and showing a great expanse of chest.

On the wing this appears to be a huge bird owing to the great length of the wings, though in reality it is comparatively small and does not weigh more than about 4 lbs. If passing overhead at close quarters, the brilliant yellow feet are plainly discernible, contrasting vividly with the surrounding black feathers.

It is said to live largely on the young and eggs of birds and has been seen to carry off a nest and examine its contents. I have seen it "drop" after lizards.

Col. Rattray describes the egg as "a very handsome one, smeared with grey and dark purple; the markings are nowhere in blotches, but smeared, running round axis of egg." As many as 3 eggs have been found in one nest. They measure about 2·6 by 1·95.

TYPE D.

FAMILY FALCONIDÆ.

SUBFAMILY FALCONINÆ.

Genus *Spizaetus*.

No. 1212. *Spizaëtus limnaëtus*, The Changeable Hawk-Eagle.

Characteristics. Primaries exceeding the secondaries by less than length of tarsus; claws much curved, hind claw longest; tip of primaries in closed wing falling very far short of end of tail; feathering of tarsus does not extend to the division of tœs; crest rudimentary or wanting.

Colouration.

The whole of the upper plumage more or less umber brown, the feathers varying from dark brown centres to light brown edges. The head and neck generally much darker brown, the feathers pale edged. Quills brown as also the tail.

The undersurface generally, including wings and tail light grey, both wings and tail much barred.

Chin and throat almost or quite white with 3 streaks, one in the centre and one on each side, blackish.

The change from the young to the adult is gradual but considerable like in all Spizaeti.

"Bill dark plumbeous, with black tip; cere dark leaden in adults, yellow in the young "? irides leaden grey, pale straw coloured or golden yellow; feet yellow." (Blanford, for S. cirrhatus).

Measurements.

"Length 26″ to 29″; tail 11″ to 12″; wing 16″ to 17″ tarsus 4″. (Blanford.)

Besides the above Dr. Blanford describes a dark or melanistic form which he describes as blackish-brown throughout, in which the basal half of the inner webs of the quills and the lower surface of the rectrices are grey. Another form still is chocolate brown generally. In these the bill and cere are black.

Habits, etc.

I have never seen this species, to be absolutely sure of, in the Punjab, though Blanford records the distribution as "as far west as Kumaon and probably to Kashmir". In April 1917 I saw a pair of obvious "Spizaeti" in Dharmsala, which must have been *S. limnœtus* as neither of them had crests.

The birds arrived one evening, presagers of a big storm which lasted for 3 or 4 days, during which time they hung about the top end of the Cantonments, and suddenly disappeared never to be seen again.

I tried hard to catch one but had no luck, though I could easily have shot one and on more than one occasion got to within 20 yards, but of course, never when I had my nets at hand.

Like the next species this is a great hunter and does a considerable amount of damage among the *Phasianidae.* In Gurhwal he is known as the "moor-haitah" or peacock killer, and Mr. Thompson (in "Hume's Rough Notes") gives a very good account of this species killing a peacock, which he himself saw done.

Mr. Thompson says, "the difference in habits between this bird and the next (Hodgson's Hawk Eagle) is, the latter, "is confined to the deep wooded hills ascending far into the interior of the Himalayas to almost the snow line........whereas the other (the present species) is always found in the Bhabur forests and does not ascend the hills to any great height, and never is found in the interior of them."

It builds in trees the usual platform of sticks lined; with fine roots and stems, and lays usually two eggs, of which I can find no description.

Since writing the above I have been fortunate enough to catch a very fine specimen of this species, on the bank of the Upper Bari Doab Canal, in the Gurdaspur District, and some 13 miles from that place. While motoring past I heard a call which was obviously that of a "*Spizaëti*" but still somewhat different to *S. nepalensis* with which I am familiar. On a tree overlooking an "escape," I found the bird and a few yards further on a second one. My net and a couple of quails, always carried for bait, were soon got out of the motor and a nice place selected for the erection of the little vertical net (the "doguzza" of the Indian falconer). The spot selected was some 100 yards from the nearer bird, and equally visible to both. I got behind a convenient bush, not five yards from the net, and had not been there more than 2 minutes when the eagle dashed into the net.

Unfortunately its impetus carried the net into a bush a few paces further on, which I had carefully selected as a good back ground for it, and between the struggles of the eagle and the thorny bush, the net was torn to ribbons and the eagle would have escaped had I not been in hiding so near. The other one continued calling and from its darker breast plumage, I put it down as a youngster. While I was securing the eagle, having got it out of the net or what remained of my net, a third one appeared on the scene and flew into the branches of an adjoining "seeshum" tree. The one I took to be the youngster at once left its perch and sat down alongside the new arrival, still continuing its plaintive wail.

I have been over this bit of country times out of number, and at all seasons of the year, for the last 3 years and have never seen these birds before, but the fact of a young one being with them would point to the fact that they had nested somewhere close at hand. This was on the 29th of March, so the nesting operations of this species must take place in the winter.

The colouring of the breast of my specimen is almost pure white, with a tinge of light buff. Each feather having a dark brown centre the extent of which varies considerably. These dark brown centres form a row of irregular lines, extending from just below the throat to about the level of the flanks. Those on either side terminate in a deep brown patch, while those in the centre continue down between its legs but are lighter in colour than on the breast and throat.

Under portion of wings and tail light gray profusely barred and blotched with black.

Back deep brown: scapulars and secondaries somewhat lighter brown than the back, each feather with buff margins.

Lesser coverts lighter brown than the back, with somewhat lighter margins and the median and greater coverts, dark brown with very pale margins, some almost pure white, and the bases of some of the feathers frequently showing, pure white.

Head and neck pale buff throughout, almost white in parts, each feather with a small dark centre, making a more or less regular line of oblong dots which touch each other.

Irides lemon yellow. Crest plainly visible, black tipped.

The colouration generally is extremely like some specimens of *S. nepalensis* and a *Hieraëtus fasciatus* which I caught the other day, was also very like, except that the margins to the back feathers were not so pronounced, but taken all round, it would be absolutely impossible to differentiate between these birds by colour alone. The following, however, places them apart at once.

1. *H. fasciatus,* longer wings, no crest, irides almost invariably some shade of brown, practically never yellow.

Explanation of Plate II.

Figs. 1, 2, & 3. All represent a bird flying directly overhead.

Fig. 1 Characteristics.

Wings long and *very* broad, extending from the body in a straight even line, almost to the tip of the primaries. Very rounded at the tips and making much less of a curve behind. The rear part meeting the body almost at right angles. The wings held on the same plane as the body and only the tips of the primaries curling upwards. The tail comparatively very short and protruding very little beyond the line of the tertiaries. Sometimes spread out like a fan, in which case it hardly looks like a tail at all. Flight heavy but regular, the circles even and the wings almost motionless.

Characteristics applicable to :—

All Vultures except *O. calvus.*

Fig. 2 Characteristics.

Wings very long and narrow in porportion to their length. Held on the same plane as the body, neither curving upwards nor backwards. The fore-part of the wings very straight (when soaring only) from the body to the tips and the rear line but little rounded, meeting the body at right angles.

Tail long and very distinctly wedge-shaped.

Characteristics applicable to :—

The Lammergeyer and to *Neophron*, except that the latter has a short tail.

Fig. 3. Characteristics.

Wings short, broad and rounded ; curving upwards and backwards. The line of the wings straight and even in front and well curved behind meeting the body at a considerable angle. Tail long and protruding considerably beyond the line of the wings.

Characteristics applicable to :—

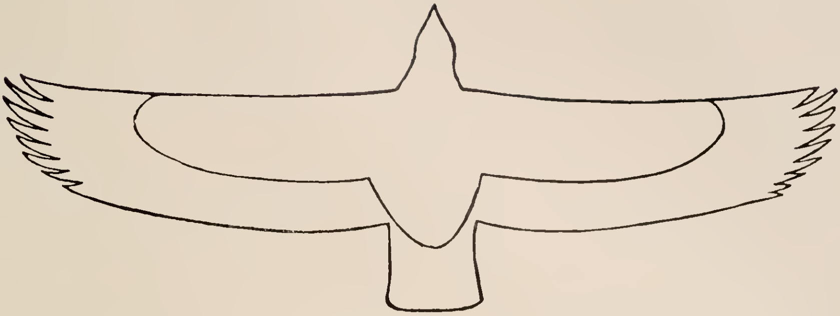
All the *Spizaëti.* All the species of *Astur* and *Accipiter* conform to the above characteristics as regards the *shape* of the wings and tail, but none of them fly with their wings held back in a higher plane to the body.

The accompanying plates and these explanatory notes thereon, are not intended to draw any hard and fast line in describing the flight of Birds of Prey. Whilst attempting to give a general idea of the genera here described, it must be remembered that the descriptions apply only to the typical and most common attitudes adopted by the birds whilst soaring, and cannot be expected to hold good at all times. For instance, the accompanying drawing of a Lammergeyer together with the above description applies to one seen soaring, with the intention of rising high into the air, and would not apply to the same bird circling in short spirals over a hill top, where he may have seen something which needs further investigation, or beating low over the hills in quest of food. In either of these cases the chances are that the fore-part of the wing will be bent back from the shoulder as though in readiness to close for a stoop, and the tips of the primaries may often be seen bending downwards and in a lower plane than is the body. The wind also appears to play an important part in the position of a bird's wings and tail.

Even though the flight of individual birds varies considerably, once the species becomes more or less familiar, on the wing, it is a simple matter to recognise it whatever be the position of its wings, at the time, as the chief characteristics are pretty well always noticeable.

Further details of flight will be dealt with in their proper place, *i.e.* when dealing with individual species.

1.



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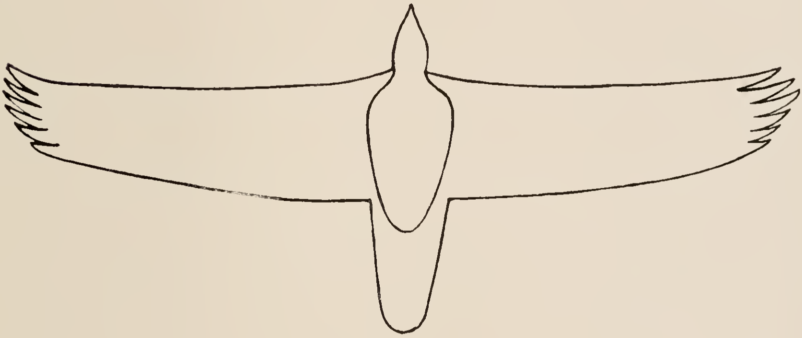
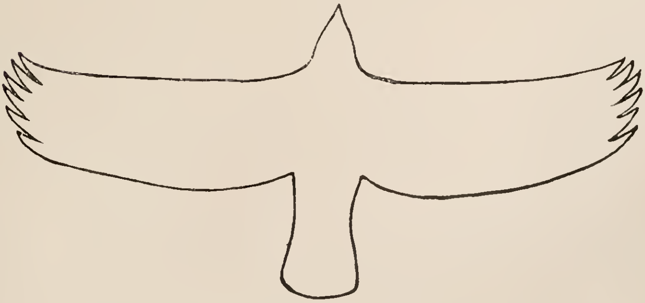


3.



THE BIRDS OF PREY OF THE PUNJAB.

2. *S. limnaëtus,*	shorter wings, short crest, irides usually some shade of yellow (gray in a very young bird), tarsus *not* feathered to the base of the middle toe, *i. e.* the feathering stops just short of the division of the toes.
3. *S. nepalensis,*	wings and eyes as in *limnaëtus,* crest conspicuous and about 3 inches in length; tarsus feathered to the base of the toes.

Type D.

Family FALCONIDÆ.

Subfamily FALCONINÆ.

Genus *Spizaëtus.*

No. 1213. *Spizaëtus nepalensis,* The Hodgson's Hawk-Eagle.

Characteristics. Primaries exceeding secondaries by less than length of tarsus; claws much curved, hind claw longest; tip of primaries in closed wing falling very far short of end of tail; feathering of tarsus extends to the division of tœs; a prominent crest 3″ to 4″ in length.

Colouration. Upper surface varying from dark to light brown, darkest on the scapulars. Top of head and crest black, the latter tipped white except in very old birds when the white tip is lost. Lower surface much lighter than the upper, varying from fawn to white with dark markings on the feathers. The undersurface of the open wing is pale grey much barred, as also the undersurface of the tail.

The breast and underparts vary, according to age from pale fawn throughout, with darker shaft stripes in some birds, to pure white with black spots to each feather, in others. The crest feathers are black, tipped with white, but in some old birds, the white tip is wanting. Blanford, in his description of the Crested-Hawk-Eagle, mentions this peculiarity, but omits it in the description of this species.

Bill black; cere blackish; irides yellow, orange in very old birds, and pale greyish yellow in very young ones; feet pale dirty yellow.

Measurements. Length 27.5″ to 29″; tail 12½″ to 13½″; wing 17″ to 18½″; tarsus 4″.

Habits, etc. This fine Eagle is well distributed throughout the Punjab Himalayas, extending from Kashmir to the borders of the United Provinces, though it appears to be more partial to certain localities than to others. Comparatively common in Bhadarwa and Chamba, it appears to skip the ranges intervening between Dharmsala and Kulu and appears again in the Kulu valley. Rare again in the Sutlej valley, where I only saw it twice in some 8 years, to reappear in fair numbers in the Jubal and Taroche States.

Unmistakable in its flight, as it is in the hand, at least as a Spizæti if not as *S. nepalensis.*

Very short rounded wings, long tail and the wings held well back, as in the Bonelli's or the Golden. The under surface, in an adult looks a beautiful silvery white from beneath, closely dotted and barred. In the breeding season, and more or less throughout the rains, this bird is very noisy, and frequently gives vent to a shrill but not unmusical whistle composed of several short notes.

The call is not unlike that of a monal pheasant and is perfectly initiated by the Himalayan Jay (*Garrulus bispecularis*).

A great hunter in its wild state, it is most disappointing in captivity, seldom aspiring to anything bigger than a hare, and not in the least inclined to pursue its quarry any further than a Sparrow Hawk.

For three years I experimented with different birds, from the fledgling, taken from the nest, to an ancient bird with orange eyes, but with very small results. My total bag for the 3 years with some 7 birds was, a few hares, an houbara which was the result of a mistake, for the houbara anyway, as it evidently did not realise it was being pursued and ran into a bush where it was ignominiously pounced on by the eagle, a village cat and, the most wonderful achievement of the lot a Tawny Eagle. The latter carried off a Luggar falcon which I had thrown up as a decoy for a Peregrine Falcon, with a ball of feathers covered with nooses in its claws. My falconer who had the Eagle on his wrist at the time, loosed him and much to our surprise, the Hawk-Eagle made straight for the Tawny and pulled him down before the latter had gone 200 yards. This was about the longest chase we had seen with these birds and was provided by an eyass which I had taken out of the nest.

Like most hawks, the Hawk-Eagles are gifted with considerable speed for a very short distance, and in its wild state the bird spends its time seated on a tree at the head of a nallah, where pheasants are wont to feed, and when one gets directly beneath the branch on which the eagle sits, the latter drops like a bullet on to it before the pheasant knows what is happening. The nest of this species, or rather the environments of the nest, give a good clue to what the youngster is fed on. Strangely enough the Koklass pheasant, which is the speediest of all the Phasianidæ, appears to suffer most, along with doves and flying-squirrels. This species appears to despise crows as I have not seen the feather of a single crow near any of the many nests I have examined.

They usually build on Deodar trees in dense jungle, but almost invariably with a clearing or a glade close at hand, and always with a dead tree near the nest, on which the youngster first practises using his wings.

In Vol. XXII, page 800 of the Bombay Natural History Society's Journal, Mr. Dodsworth gives an account of a nest which he found in the Simla Hills on a cliff, not on a tree, and obtained two hard set eggs in February. Mr. Dodsworth states that the natives call this bird the "Mariari" but this I think is a mistake. "Mariari" is the name by which the Golden Eagle is known in most of the Punjab hills, except in Khanawar (Bushahr) where he rejoices in the name of "Dhungshoorish" or the "monal tiger". The Spizaëti are more commonly known as "Shiah Baz "or "Kuldar", but no reliance can be placed on names given to birds of prey by villagers. Falconers are the only class of people in India who have any uniformity in their nomenclature, and ordinarily, it would be nothing uncommon to be given three different names for the same bird, by three different men in the same village.

The eggs are said to be greenish white, sparingly spotted or streaked with reddish brown and pale purple, and measuring 2·7 by 2·2.

This species is easily caught and not difficult to tame and train. Anything from a rat to a country fowl will do as a bait, and the small vertical net seldom fails to catch it. Once, however, it discovers the trap, one has to be up very early in the morning (literally), to be successful. An old bird which I had caught and which subsequently escaped, learnt the lesson very thoroughly and was not going to be caught napping again. I tried it with every, kind of bait and trap, but it evidently recognised me as its enemy and connected me with traps, for if reasonably near, it flew off the moment it saw me, or if at a safe distance, it merely sat on and took not the least notice of my pigeons, and rats, and chikors. Finally I was fortunate enough to see it fly into a tree late in the evening, and kept a careful watch until it got quite dark and so made sure it meant to spend the night there.

Next morning I was on the spot long before daylight, and a moon, in its last crescent, helped me to locate the bird from below.

The net was soon erected and a lively rat tied up behind it, and I took cover behind a neighbouring bush and patiently waited for daylight. Through the branches of the bush I could just see the eagle against the sky. As it became lighter I could see that it slept with its head under its wing. Finally a Koklass called, and a little while later the jungle was awake and full of a variety of sounds and the eagle too bestired itself. Its first action was to stretch out one wing and a leg and almost immediately after it went through the usual contortions of a bird of prey casting its pellet. My rat was still in comparative darkness and I began to think the eagle would move off without seeing it, when suddenly the sharp eyes caught the movement, and the head nodded two or three times in the direction of the net and the next instant, the bird was safe in the net. Much given to soaring and, in the breeding season, talks most whilst in the air.

They usually soar in pairs, but a pair seldom hunts together, and though both may be in the same ravine, they select different trees, usually a good distance apart, on which to wait for game.

During the day, the very top of a tree or a large branch of some dead tree may be selected for their midday rest, but when on the look out for game, they almost invariably take up their position somewhere in the middle of a tree, which is well covered with foliage, and are thus well concealed from view.

Though this species is said to lay two eggs I have never seen more than one young bird in a nest, or accompanying the parents.

The parents appear to drive the youngster away from their special nallah, very soon after he has learnt to fly, and about one month's tuition in the art of catching game is all they seem to consider necessary for him.

TYPE E.

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus *Archibuteo.*

No. 1242. *Archibuteo hemiptilopus.* The Himalayan Rough-legged Buzzard.

Characteristics. Head feathered; tarsi feathered to the toes, *in front only*, naked behind.

Colouration. "Upper parts brown, feathers of nape and upper back broadly edged with rufous, a few of the wing-coverts the same in some specimens; upper tail-coverts with rufous or buff tips and bars, bases of nuchal feathers white; quills as in Buteo, ferox, white; tail brown above, sometimes pale rufous in part, whitish below, barred darker; lower parts brown, with or without rufous, or white with brown spots on the throat and breast; flanks and thigh-coverts always brown. When the lower parts are brown the middle of the breast is often white or rufous." (Blanford.)

"One specimen is dark chocolate-brown throughout, there is scarcely any white even on the bases of the primaries, and pale bands only on the basal portion of the tail." (Blanford.)

Bill dusky horn-coloured, yellowish laterally at base of mandible; toes and naked part of tarsus livid waxy, claws horny black.

Measurements. Length 28″; tail 11 ; wing 20″; tarsus 3·25″; mid-toe without claw 1·75″; bill from gape 1·9″″.

Habits etc. This rare bird only appears to have been obtained about half a dozen times altogether in this country, at high elevations, in Sikhim, Nepal and Kulu.

The only thing known of its nidification is a note in the Journal of the Bombay Natural History Society, Vol XIX page 523, by Lieut. Bailey who found it near Gyantse, Thibet, in September 1908.

Mr. Bailey says that this bird feeds on hares and snow cock, which were very plentiful in the vicinity of the nest, and also states that it is said to do damage among the flocks by killing young lambs.

This being the case the Rough-legged Buzzards must be a very different bird to his very near connections, which are much more common in the Punjab, *viz.*:—the Long-legged and the Common Buzzards, which are quite content to exist on rats, lizards, frogs, etc.

I have never seen this bird, to my knowledge, so cannot describe his flight, but since he resembles the members of the genus "Buteo" in other respects, his flight is probably similar, yet the fact of his being able to kill the Snow-cock, shows that he has a considerable turn of speed as well as strength and courage, far surpassing the other buzzards.

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PROGRESS OF THE MAMMAL SURVEY.

As announced in the circular in the last Journal the Committee have decided to carry on and if possible complete the Survey of the Mammals of India, Burma and Ceylon commenced by this Society in 1911. Arrangements are in progress for obtaining collectors to commence work if possible in October next.

The following subscriptions have been received towards the Mammal Survey Fund from June 1915 to 30th April 1919, and it is hoped that members will send further subscriptions :—

Names.	Amount.		
	Rs.	a.	p.
Amount previously acknowledged and invested in Bombay Port Trust Bonds	5,000	0	0
Annandale, Dr. N.	16	0	0
Anonymous	15	0	0
Bridgeman, The Hon'ble Major H. G. O.	58	14	5
Budd, Lt.-Col. N. A. H.	50	0	0
Ball, H. P.	10	0	0
Bird, Rev. A. F. R.	3	8	0
Bannerman, Surgeon-General W.B. (C.S.I., I.M.S.)	16	10	6
Clifford, Major R.	20	0	0
Chatfield, H. S.	55	0	0
Culbertson, J. M. S.	4	8	0
Connor, Lt.-Col. F. P. (I.M.S.)	10	0	0
Cochin Government	250	0	0
Davis, G. (I.C.S.)	15	0	0
Evans, Col. G. H. (C.I.E., F.L.S.)	75	0	0
Erb, E.	15	0	0
Elliott, R. E. A. (I. C. S.)	30	0	0
Forsyth, Dr. Wm.	9	12	0
Fellowes, Kyrle	5	0	0
Frei, Max	10	0	0
Fry, John T.	10	0	0
Fletcher, Capt. A. B.	20	0	0
F. M. S. Government (2nd Donation)	875	0	0
Do. (3rd ,,)	870	0	0
Government of Bihar and Orissa	1,500	0	0
Gillum, The Hon'ble Mr. S. J.	10	0	0
Gosse, Capt. P. H. (R.A.M.C.)	17	10	0
Hannyngton, F. (I.C.S.)	20	0	0
Hanhart, S.	50	0	0
Huggins, J. R.	30	0	0
Heath, R. H.	18	8	0
Hayne, A. R. S.	13	8	0
Julius, V. A.	20	0	0
Kilkelly, Lt.-Col. P. P. (I.M.S.)	10	0	0
Lowndes, D. G.	15	0	0
Lloyd, Lt.-Col. C. R.	150	0	0
Mitchell, F. J.	15	0	0
Macaulay, F. G. A.	10	0	0
Ormiston, W.	50	0	0

Names.				Amount.		
				Rs.	a.	p.
Parrington, Lt.-Col. J. W.				100	0	0
Phipson, H. M.				1,000	0	0
Purkis, F. C.				15	0	0
Schmid, W.				20	0	0
Smith, A. Kirke				15	0	0
Sanders, D. F.				10	0	0
Sprott, F. H.				15	0	0
Scott, Major F. B.				15	0	0
Simonds, Major M. H.				14	0	0
Smith, Dr. Malcolm				50	0	0
Tweedie, A. G.				20	0	0
Thomas, Oldfield (F. R. S.)				659	12	8
Tyrrell, Major J. R.				15	0	0
Tyler, H. H. F. M. (I.C.S.)				100	0	0
Walton, Col. H. J (I.M.S., C.M.Z.S.)				100	0	0
Whistler, H. (F.Z.S., M.B.O.U.)				10	0	0
Watson, E. A.				3	0	0
				11,535	11	7
Interest credited by Bank on Current Account up to 30th April 1919	Rs. 46	12	10			
Interest on Fixed Deposits up to 30th April 1919	„ 624	4	0			
Interest on Bombay Port Trust Bonds up to 30th April 1919	„ 757	4	8	1,428	5	6
Promised.						
Mr. W. S. Millard	Rs. 1,000					
„ E. Comber	„ 1,000			2,000	0	0
Total				14,964	1	1

MISCELLANEOUS NOTES.

No. I.—THE TIGER AND THE TRAIN.

About a month ago a curious incident occurred on the G. I. P. main line where it runs through the Satpuras near Asirgarh.

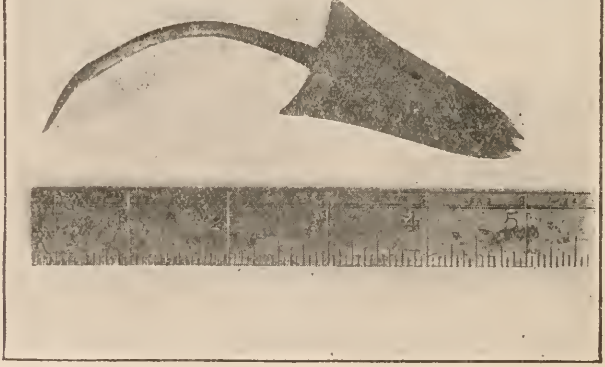
Some surface men walking along the permanent-way came on the end of a tiger's tail lying beside the rail. It had obviously been quite recently cut off by a passing train. An inspection of the grass on the adjacent bank showed that some animal had made off with difficulty and a few steps were sufficient to bring part of the tiger into view. The surfacemen considered a closer inspection would be imprudent, although on their way to the nearest village they stoutly maintained to themselves that the tiger was dead, and they were thus able to impress on the local Shikari the simplicity of firing a bullet into its carcase and claiming the reward which Government pays for the destruction of tigers. The Shikari and the surfacemen promptly returned to the spot and the former (no doubt with a reduced charge for economy's sake) fired at the tiger, which at once got up and mauled him. While this was taking place a keyman on the G. I. P., who was also present, ran in and split the tiger's skull with an axe. The unfortunate Shikari died subsequently of his wounds. The tiger was found to have been struck by a passing train in the hind quarters and badly damaged. As such an occurrence must be very unusual it may be of some interest to the readers of the Journal. It is difficult to conceive how such a cautious and active animal as a tiger could get caught by a train: it might be accounted for by the passing of two trains simultaneously, or again the tiger at the last moment may have thought the other side of the track afforded more cover and security. I have heard of several instances of leopards being killed by trains, but these animals are much less timid of man and all his works than tigers are.

Khandwa, C. P.,
November 1918.

A. A. DUNBAR BRANDER, I.F.S.

No. II.—ARROW HEAD IMBEDDED IN A TIGER'S BACK.

I enclose a photograph which may be of interest to members of the Society. It represents an arrow head found imbedded in the flesh of a tiger which I shot last Christmas. The wound was evidently an old one, for skin had grown entirely over it and only a small patch of slightly lighter-coloured hair marked the spot on the beast's back where the arrow had entered.



The tiger was well known in the district as a troublesome fellow, who held up travellers and bullock carts from time to time. His nasty temper is perhaps not to be wondered at, seeing that he had such a "thorn in the flesh."

J. G. RIDLAND.

BOMBAY, 19*th February* 1919.

No. III.—SIZE OF TIGERS.

On reading Col. R. W. Burton's tiger notes from the Oriental Magazine I looked up my Volumes of Oriental Magazine from 1830-1833 and found "A. Mull" gives measurements of a tiger, killed by him and Capt. D— in Khanded as 12′-2″ when dried and 11′-9″ shortly after death, also of a tigress of 9′-8″ and a panther of 9′. Any tiger in that or the Ajunta country was in 1829 considered small if under 10′-9″. A pity they did not give the weights. "Lowry Todd" says in 1832 that he had seen about 100 skins of tigers in the Mahratta Country and measured many just after death and none was over 9′-5″ in length. He also asks if there is any truth in the popular idea of a tiger's age being told by the number of lobes in his liver and says that he found a big old tiger with 12 lobes, an old tigress with eleven lobes, a young tiger had 7 lobes and a cub 4 lobes. Has this been tested by any of your readers?

R. LIGHT, LT.-COL.

HASTINGS, ENGLAND,
16*th October* 1918.

No. IV.—TIGRESS (*FELIS TIGRES*) ATTACKING A SLOTH BEAR (*MELURSUS URSINUS*).

On the night of the 10th of this month a tigress and cubs killed one of my kills in a nullah, and I sat up with a friend. It was a bright moonlight night. About 7-30 we suddenly heard an appalling noise about 150 yards away on our right and behind us. It sounded like two tigers fighting. Then we saw a bear coming hurrying and stumbling along the nullah from our right. It was gasping for breath, and when it got just in front of up on the opposite bank of the nullah, it suddenly uttered a roar and jumped round, as bears do when they think something is attacking them. I thought the tigress must be following, so I advised my friend not to shoot. The bear now went on a few yards, and sat down to get breath, gasping and occasionally moaning. Then it went off towards our left, still muttering and complaining, and unfortunately for itself crossed the nullah into the jungle behind us. Suddenly the uproar commenced again, and it was obvious that the tigress had gone for the poor old bear again. The howls of the bear, and the roars of the tigress went off through the forest, and gradually faded away in the distance. After they had died away I heard tho plaintive calls of what I thought at the time were bear cubs, but which might have been tiger cubs, going off in the same direction. The tigress never came back to the kill. I have heard of tigers killing bears, but I suppose I shall never be so near seeing the performance as I was on the night of which I write.

J. A. DUKE, D.S.P.

NIMAR, 4*th March* 1919.

No. V.—MONGOOSE (*MUNGOS MUNGO*) KILLING A HEDGEHOG.

Going along the road in my car this morning I saw a mongoose attacking a hedgehog on the edge of the road. The car passed within a few feet of them and the mongoose only drew back for a second. The car was stopped thirty yards down the road and I watched events. The mongoose was scratching at the hedgehog which was in a ball and was trying to bite at the depression which he knew was the vital spot. There was a wall along the road so I got out of the car and went along behind it till I arrived opposite the place where the struggle was taking place. I was about six yards from the two animals and watched them for a quarter of an hour. The mongoose kept on scratching at the hedgehog and biting it. Then it seemed to spit out something probably bristles from its mouth. The mongoose got rather blown after a few minutes. Its mouth was open and it was panting hard. After another effort it took a rest lying down by the hedgehog with its hindlegs spread out. During this time it occasionally sniffed the hedgehog and kept a sharp look-out. Then it made a prolonged attack on the hedgehog scratching and biting at the vital spot and sometimes rolling over with it. At last it got a firm hold of something with its mouth and I could see the hedgehog being gradually forced open, but could not tell where the mongoose's grip was. The hedgehog began to squeal loudly, a most unpleasant sound. The mongoose then dragged the hedgehog across the road and along the wall to a bush at the corner, the distance being about thirty yards. I moved along the wall and could just see the mongoose moving about in the bush. Then a man came near and the mongoose ran away. I got the hedgehog out and found it rolled up and still alive. I could not wait any longer so put the hedgehog back in the bush. On my return an hour later the hedgehog was lying dead just outside the bush. On opening it I found that its head been bitten out. The mongoose must have returned finished it off and again been frightened away. Three hours later the hedgehog was not to be found. From an inspection of the hedgehog it did not seem as if the mongoose had bitten off a number of bristle and so got a hold on the flesh, but I should imagine that the compressing muscles of the hedgehog must eventually become weary and a very slight relaxation would allow the mongoose to get its mouth into the aperture. Whatever the cause it is probable that there is only one result when a mongoose sets to work on a hedgehog.

E. O'BRIEN, Lt.-Col.

Porbandar, *27th October* 1918.

No. VI.—NATURAL DEATH OF A FOX (*VULPES BENGALENSIS*).

As notes appear occasionally in the Journal on the subject of the natural death of wild animals, the following incident may be worth recording. I was out riding early in the morning and noticed a fox (*Vulpes bengalensis*) lying on the ground. As I passed by near it I was much surprised to see it simply curl itself up in a ball as if it was going to sleep till the sun rose and warmed it a bit. I thought its behaviour seemed very tame as the spot it selected was an open bit of grass land though in the neighbourhood of fields.

As I was on my way home some three hours later, my attention was attracted by some 3 or 4 white backed vultures (*Pseudogyps bengalensis*) sitting on the ground doing nothing in particular. On getting near I found one was mauling the mangled remains of skin, etc., of the unfortunate little fox. Presumably it was not caught asleep but chose this spot to die in.

Unao, *5th March* 1914. G. O. ALLEN, i.c.s.

No. VII.—SPOTTED DEER (*AXIS AXIS*) AND WILD DOGS (*CUON DUKHUNENSIS*).

On the 4th of January I went out from my camp for an evening stroll after cheetal. I took with me three long dogs and a terrier in case I wounded an animal. Going through the jungle I saw a fine little fox slipping away, so, as there seemed to be no cheetal just there, I loosed my dogs on the fox. They went off, and I lost sight of them. Before they came back I heard from a small teak plantation in the opposite direction the unmistakable noise of a pack of wild dogs in full cry. I rushed along in that direction, and had only run about 20 yards when some cheetal hinds rushed out past me with two wild dogs stretched at full speed after them. I could not get a shot in, and they disappeared over a small hill. I then dashed into the teak plantation as I heard more wild dogs calling there. My orderly caught a glimpse of five of them, but I did not; and I turned back to collect my own pack as I had visions of their being killed by superior numbers of wild dogs. I assured myself that my dogs had returned, and then I proceeded in the direction the first lot of cheetal hinds had been chased. I suddenly saw a wild dog standing on a little hill about 100 yards away. I moved a bit closer, and saw there were two dogs. They both looked rather out of breath and excited. Suddenly one of them dashed forward at something I had not seen before and which now turned out to be a small cheetal fawn. This fawn had been lying on the ground, and had suddenly jumped to its feet and tried to escape. The dog which rushed at it merely knocked it over and then stood aside. The fawn again made a dash to escape, and the other dog rushed after it and knocked it over. Neither made any attempt to tackle or kill it. I was dodging about trying to get a steady shot, but could not on account of the dogs' movements and trees in the way. The third time the fawn sprang up it luckily rushed past me. One dog dashed in pursuit, and, as it passed, I dropped on one knee and whistled. The dog broke away from me, but drew up about 30 yards off staring at me, so that I had no difficulty in knocking it over. The other dog went off like a flash. So did the fawn, and seemed none the worse for its tumbles. I was using a Manlicker rifle with nickel bullets, and the wounded dog being shot on the stomach went about two miles before dying. I tried to put my dogs on to him, but there were too many fresh cheetal traces all over the place for this to succeed. I have never before heard of wild dogs playing with their prey.

J. A. DUKE, D.S.P.

NIMAR, C. P., *4th March* 1919.

No. VIII.—EXPECTED PLAGUE OF FIELD RATS IN 1920.

The famine of 1918-19 will almost certainly be followed by a rat plague in North Gujarat, Rajputana, South East Sind, Kathiawar and the East Deccan in the winter of 1920-21. This sequence—monsoon failure followed by a plague of rats two years later—is now well known and established. The following are the best authenticated cases:—

Failure of monsoon	Rat plague in winter of
1876	1878-79.
1899	1901-02.
1911	1913-14.

In the Statistical Atlas of the Bombay Presidency, Edn 1906, in discussing the rat plague after the 1899 famine, the schedule on p. 16 attributes the plague to the winters both of 1900-01 and 1901-02. But this is evidently incorrect, since on reference to the district accounts of all the infected districts it will be found that rats are only mentioned as having been a pest in 1901-02.

The frightful destruction of crops caused by these plagues can be judged by the following rough estimates, which are based on my own experience of the rats in North Gujarat in 1913-14. Revenue assessment (in 1906) of the Ahmedabad and Kaira district—Rs. 34½ lacs. Deduct 14½ lacs for land such as rice lands, the crops on which are not liable to damage by rats—Rs. 20 lacs. Assume that the average gross money outturn is now about 50 times the assessment—Rs. 10 crores. Assume 5°/₀ of the gross outturn to be destroyed by rats—result, loss of Rs. 50 lacs in two districts alone. I have taken 5°/₀ as a conservative estimate. From personal observation I should say that in some talukas, such as Prantij, the damage in 1913-14 was much higher, and in individual fields of "math" as high as 50°/₀. From this it follows that precautionary measures are quite worth taking, should any be known. And there is ample time to organize them.

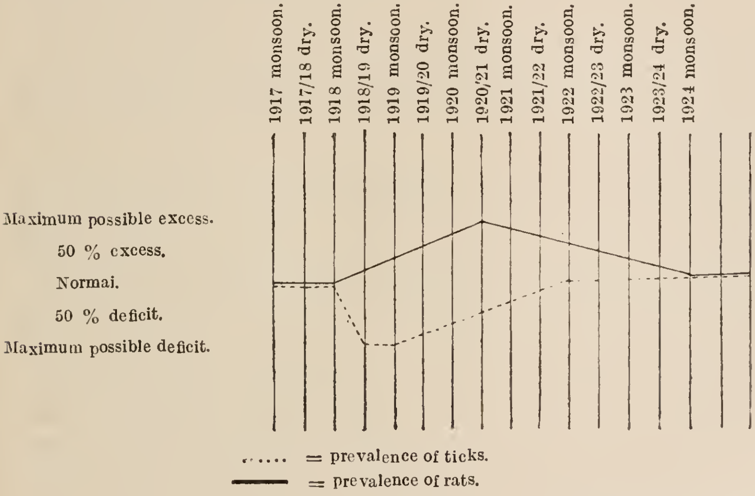
It would be best if preventive measures could be based on such knowledge as we possess of the life history of the field rat species, and of the causes both of the rise in their numbers and their subsequent return to the normal. The cause to which these rat plagues is usually attributed is the diminished mortality among the young broods in the year of monsoon failure through the absence of water to drown them in their burrows. It is doubtful whether this drowning of young rats in normal monsoons has been definitely investigated and proved. If not the cause assigned is purely theoretical, and is therefore open to argument. A great objection to it is that the fields worst infected in North Gujarat in 1913-14 were the highest fields with the sandiest soil, *i.e.*, the fields least liable to water-logging in a normal year. The ordinary monsoon rainfall in such fields runs off easily, and so much as does not run off soaks through the light sand. The causes of natural phenomena are often not the most obvious; and a remark in the Statistical Atlas suggests another possible clue. In speaking of the *cessation* of the 1878 plague, the compiler wrote:—"It is conjectured that a parasite (a red tick found on the bodies of the rats) may have aided in the work of destruction." It is possible that in normal years the multiplication of the rats is kept down by the attacks of this, or some other, parasite, and that the failure of the monsoon is prejudicial to the parasite. Ticks breed in grass, and there is a noticeable diminution in the grass crop in a famine year. On the other hand they do not feed on the grass, but use it merely as a jumping-off place. And even in a famine year there would be herbage high enough for the ticks to attach themselves to rats. A more probable cause of the diminution in the number of ticks would be the diminished humidity. Animals, like plants, are influenced by the humidity of the air, and some species find their optimum only in a fairly humid atmosphere. The ticks which attack travellers in the Kanara Forest country are an example of this. These ticks find their optimum in the heavy rainfall belt on the crest of the ghats, and diminish in numbers rapidly as the rainfall decreases eastward. Whether the Eastern limit of ticks and the lines of equal prevalence recede westward in years of light rainfall I do not know. But it seems reasonable to suppose that this is the case. And in the same way the rat tick may easily diminish in numbers in years when the humidity in July to October is noticeably below the normal.

Should the above theory be correct we can get little hope of preventing the rat plague in 1920-21 along nature's own lines. The mischief will now have been done, and artificial breeding of ticks is presumably beyond the bounds of practical operations. It would be necessary therefore to find some other *modus operandi* of a more direct kind such as poisoning or digging up of burrows in the breeding season. But it is beyond the scope of this note to do more than draw attention to the impending evil.

L. J. SEDGWICK.

DHARWAR, *7th January* 1919.

It may be argued that if the multiplication of rats is due to decrease in prevalence of ticks then the greatest prevalence of rats should occur in the year following the greatest decline in ticks, *i.e.*, (in this case) 1919-20. But if we assume that the recovery of the ticks is spread over two or more seasons it may take time for the repressive influence of the ticks to get the better of the impetus which has been given to rat-multiplication in the meanwhile. The appended theoretical graph will explain this argument. It will be noticed that the rat prevalence begins to fall at the point where the tick prevalance riches the half way point between maximum deficiency and normal. The graph is drawn on the assumption that the monsoons of 1917, 1919, 1920, 1921, 1922 and 1923 are normal. In practice the actual graphs would be much more complicated, and in a long series of years the two lines would constantly cross.



Mr. Sedgwick has done well to call attention to this interesting phonomena which is of such great economic importance.

The first thing we want to know is what are the kinds of rats, which cause these plagues, and I would appeal to members to send in specimens of rats should there be a plague next year. Of the more recent plagues there is not, as far as we know any record of the species concerned, but fortunately two good naturalists Sir Walter Elliot and the Rev. Mr. Fairbank of the American Mahratti Mission at Ahmednagar have put some facts on record. Sir Walter Elliot writing in the Madras Journal of Lit. and Science many years ago remarked that owing to "The monsoon of 1826 having been deficient at the commencement of the season, the mettades bred in such numbers as to become a perfect plague. They ate up the seed as soon as sown and continued their ravages when the grain approached maturity, climbing the stalks of the jowaree and cutting off the ears to devour the grain with greater facility. I saw many whole fields completely devastated so much so as to prevent the farmers paying their rents." In 1912 Capt. G. C. Shortridge, one of our Mammal Survey Collectors was collecting in the Dharwar District, the district to which Sir Walter Elliot refers, and wrote of the mettades which are now called soft furred rats *Millardia meltada* as being "confined almost if not entirely, to the black soil country, where it is probably the chiefly destructive to cotton crops. These rats, in favourable seasons, increase in such enormous numbers as to eat down the crops of an entire district. While at Dharwar I never found the species so plentiful as *Tatora* or *Gunomys*, although there is no doubt that at times it becomes a plague."

Writing of the plague in 1878-79 Mr. Fairbank says that the Indian Gerbille *Tatera indica* was the primary culprit. He describes how this plague extended over several thousand square miles principally in the Ahmednagar and Sholapur Collectorates and the adjoining Native States. This plague was first noticed in the end of 1887 when the Rabi (winter) crops began to ripen. At first writes Mr. Fairbank "stalks were cut down here and there in the fields but more were cut as days went on. And afterwards fields were suddenly attacked and destroyed in a few nights. When food became scarce where they were, the rats gathered their forces and an army of them invaded fields that had not been harmed before and quickly destroyed them." Besides the Indian Gerbille the soft-furred Field Rat was also, in all probability, responsible for a good deal of the damage as Mr. Fairbank remarks that "In some places they did not cut down the stalks but climbed them and gnawed off the ears of grain" a habit as we have seen from Sir Walter Elliot's paper he noticed in the latter animal in Dharwar.

The Southern Mole Rat *Gunomys kok* too was probably responsible for some of the damage, but Mr. Fairbank says only in small numbers. Apparently then in the Ahmednagar district the rat plague was caused by the following species in the order given :—Indian Gerbille, Soft-furred Field Rat and Southern Mole Rat, while in the Dharwar District Capt. Shortridge considered the order of destructiveness to be as follows :—Indian Gerbille, Southern Mole Rat, Soft-furred Field Rat, though in Walter Elliot only mentions a plague of the last named.

In 1909 the Society was sent two examples of the Sind Mole Rat, *Gunomys sindicus* which was said to be a regular plague in the Indus Delta.

As regards the breeding habits, I may briefly mention the following facts. The Indian Gerbille generally makes its hole in or about a hedge or bush, while the Southern Mole Rat burrows are found right in the open, along side a bund or, as often as not in the jungle but they are always easy to tell by the mole like mounds thrown up outside the burrows. The soft-furred field rat on the other hand is found in old walls, heaps of stones, but principally in cracks in the sunbaked soil. These differences in habits may account for what appears to be different times of year when the plagues take place. Sir Walter Elliot's record seems to point to a plague in the middle or end of the monsoon, while as Mr. Sedgwick has pointed out according to official records the plagues take place as a rule in the cold weather, two years after the failure of the monsoon.

The 1826 plague is attributed by Sir Walter Elliot to the failure of the early rains and consequent great increase in first broods of rats, many, which are as a rule drowned at that season, escaping. That many rats are drowned by heavy rains is shown by Mr. T. Davidson, who writing to Mr. Fairbank says from Hadha in the Sholapur Collectorate on May 20th, 1879, says "there was a grand slaughter of rats on Monday night and Tuesday. It rained 2·65 inches and in the morning the whole black soil was covered with dead and dying rats, sticking in the mud. The people say half of them have died." Sir Walter Elliot says of the Mettades that number perish at the beginning of the rains owing to the cracks filling up their hole or falling in on them. In the monsoon probably large numbers of rats are killed one way or another, but I do not think that when the rains are a failure, that alone is the cause of the plagues. Mr. Sedgwick suggests that ticks have a great deal to do with the keeping of rats in check and the killing off the plagues. They very likely do play a part, but probably the scarcity of food is the principal cause of the plagues, and we know that abundance and scarcity of food has a great deal to do with the facundity of animals.

All kinds of rats breed chiefly in the spring, though also probably in warm climates, all the year round to a certain extent, and if this spring, when the breeding season commences they cannot get as much food as usual, the litters will be fewer and smaller in size and fewer young rats will reach maturity and take longer before they are able to breed. Rats of all kinds breed when they are a month or two old, but probably owing to the scarcity of food this will be delayed, so that even if this year's rains are good the rat population next winter will be below the average. With this years supposed good monsoon there will be abundance of food and the rats will breed next spring in numbers and produce by the following winter a regular plague.

The plagues of rats are said to disappear as quickly as they appear and at times numbers are seen dead in the fields. This points to their having been attacked by some disease which has broken out owing to their great increase in numbers. The natural enemies of rats in ordinary times keep them in check, but when once they become a plague and get beyond their natural enemies then Nature calls in other remedies in the form of some infectious disease. This may account for the quick disappearance of the plagues and for the number of dead rats seen lying about in the fields.

In all probability a certain number of the rats migrate to a less populated district but of this we know nothing. Any information about rat plagues after a famine would be most acceptable with special reference to the following points :—

(1) Kind of rat causing plague (skin and skull should be forwarded for identification).

(2) When increase was first noted.

(3) When rats began to decrease.

(4) When rats appear to be in their normal numbers again.

(5) If any great increase or scarcity of birds of prey, mungooses or other carnivorous animals also snakes during or before the plague.

(6) If any dead rats seen lying in the roads and fields (specimens should be collected and sent in strong country liquor to the Society.)

(7) Any signs of rats migrating or leaving the district.

As regards the preventive measures it is difficult to say what can be done but it is evident that the sooner measures are adopted the more efficacious they will be, and with the present scarcity of food it is evident that any method of trapping or poisoning with a bait would be of more value now, than later on when food becomes plentiful. It must be remembered that if a poison is used it must be one which is not harmful to the rats natural enemies or else much of the good done by killing the rats will be defeated if their enemies are also killed.

Killing rats when the plague is at its height will probably do little good as Sir Walter Elliot has shown.

N. B. KINNEAR.

BOMBAY NAT. HIST. SOC.,
9th March 1919.

No. IX.—PORCUPINE'S METHOD OF SHEDDING QUILLS WHEN ATTACKED.

Seeing R. D. Macleod's note in the Journal of the 15th January 1918 on "a fight between a dog and a porcupine" and his wish for information as to the porcupine's mode of attack, I give my personal experiences. At Quetta, in 1885 a brother Officer and I went for a walk in uniform one evening, taking with us two young grey hounds, 2 bull terriers, a fox terrier and a retriever. At the foot of the hills, the dogs turned a fox out of the rocks and killed it. When we came to another cavity in the rocks we let the 3 terriers go in. Before long we heard barking and fighting and presently the fox terrier came out with a quill through its lower lip and another through a fore leg. I then called the other 2 terriers as I knew how dangerous it was for them. The bull terrier bitch came out with 4 or 5 quills in each socket of her eyes and one through her chest and coming out of her side. These we took out and later found her eyes had not been touched and they and the wounds in her lungs healed up all right. While I was calling up the whole for the bull terrier dog, out came a porcupine quite close to my face and went for the two grey hounds with its quills laid back. When near them it turned the quills forwards over its head and ran at them in turn, leaving about a dozen quills in the side of each, then backed away. The quills are loosened in the skin sockets. We had only canes so threw stones at it and though we knocked out many quills it got away into the rocks. The retriever cleverly kept out of its way, only barking. Soon another porcupine came out and went back into the hole when stoned. The bull terrier dog never came out again. No doubt he got quills into his brain or heart and had so many in him that he could not turn round and get out. A dog is no match for a porcupine in its hole.

R. LIGHT, LT.-COL.

HASTINGS, ENGLAND,
16th October 1918.

No. X.—RECORD FEMALE NILGIRI TAHR (*HEMITRAGUS HYLOCIRIUS*).

In November I was out shooting "Nilgiri Tahr" on the Nelhampathies. I had got within 500 feet of a herd, who were below me on precipitous ground. I picked out what appeared to be a decent sized buck. The beast turned out to be a doe taping 14″. The biggest ♀ recorded in Rowland Ward's book or in any other authority I have had the opportunity of consulting seems to tape only 11″.

A. P. KINLOCH, LIEUT.

COLABA, BOMBAY,
31st January 1919.

No. XI.—INDIAN GREY SHRIKE (*LANIUS LATHORA*) ATTACKING WOUNDED SANDGROUSE.

This morning I shot a Sandgrouse which fell 120 yards away. When I got close to it I saw an Indian Grey Shrike attacking it. The Sandgrouse gave one flutter which frightened off the Shrike and then lay dead. The Shrike returned and began pecking at it. I watched it for a few minutes and then went up expecting to find it had attacked the eyes, but it had drilled a hole in the Sandgrouse's skull. I have never seen this before and it may be of sufficient interest to record.

It was rather cheek of a small bird like a Shrike to go for a Sandgrouse.

E. O'BRIEN, Lt.-Col.

Porbandar, Kathiawar,
1st *November* 1918.

No. XII.—OCCURRENCE OF INDIAN RED BREASTED FLYCATCHER (*SIFHIA HYPERYTHRA*) IN THE DECCAN.

In the Fauna it is stated that this bird has not yet been procured in India, when on migration between Kashmir, its summer quarters and Ceylon, its winter quarters, nor have I been able to trace in the journal any account of its occurrence outside the Himalayas.

It may, therefore, prove of interest to know that I procured a male of this species in good plumage at Bolarum (Secunderabad, Deccan) on the 28th of September last, and saw another on the 30th, two days later.

No more were seen, and the two individuals mentioned were evidently on migration. I am inclined to believe that its occurrence on this occasion was not fortuitous and that this species migrates annually down the continent of India, but has probably been overlooked owing to its similarity to *S. parva*, its European ally. I may mention that though in the Fauna it is stated that *S. parva* occurs in India down to a point considerably South of the Deccan, I have never observed it in the Deccan, and think it has probably been confounded with *S. hyperythra*, from which it may be distinguished at large by the ring of white feather round the eye, which is a conspicuous marking wanting in the latter, and by the lesser amount of chestnut on the underparts. Another rare Flycatcher shot on migration at Bolarum on 2nd October 1917, was Layard's Flycatcher (*Alseonax muttii*).

A. J. CURRIE.

Bunder Abbas, 28*th November* 1918.

[There are three skins of *Sephia parva* in the Society's Collection, two from the Satara district and one from Kolaba District below Ghats—Eds.].

No. XIII.—NESTING HABITS OF THE BROWN ROCKCHAT (*CERCOMELA FUSCA*).

A few years ago I spent the hot weather touring in the Banda district of Bundelkhand living in Canal inspection houses. Every inspection house had its pair of Brown Rockchats, which nested inside the house, usually in the bathroom, to which they had access through the drain opening when the house was shut up. I found several of the nests, which were placed either in the corner of one of the shelves in the wall or else on the cornice, and I was surprised to find that they were invariably built on a foundation of small pebbles or gravel. The foundation consisted of an irregular heap of pebbles some six inches across and about three deep and the nest was a very neat grass-lined cup, about $2\frac{1}{2}''$ in diameter and about $1\frac{1}{2}''$ deep, (I did not measure it) embedded in the gravel with its lip flush with the top of the heap. These pebbles must have been carried up by the birds. I should be glad to know whether this is the usual form of nest of these birds, as I have not seen it mentioned anywhere. Is the Rockchat a bird that is changing its habits and extending its range? Jerdon speaks of it as "found at Saugor, Bhopal and Bundelkhand, extending towards Gwalior and the N. W. Provinces". He goes on to say "It is a permanent resident of Saugor and I have always found it on the sandstone hills there, among rocks cliffs and loose stones, never coming to the cultivated ground below". I have always found it most common in districts such as Banda and Mirzapur, where there are plenty of rocky hills, but it is by no means confined to the hills and frequents cultivated land. The part of Banda where I found these nests was many miles from the hills. I have also found it common, though to a lesser degree, in many other districts of the United Provinces where there are no hills at all and nothing but cultivated land. At the same time it still seems to have a preference for anything suggesting rocks, such as *pucca* buildings, and the form of the nests I found and the fact of the usual means of access being through the small hole in the wall suggested to me that the birds were following instincts inherited from some time when they may have been confined to rocky country. But I imagine that in any case Jerdon's information must have been incomplete and the change in habits, if there has been one, cannot have taken place in the 50 years since he wrote.

L. S. WHITE.

HARDOI, OUDH,

23rd February 1919.

No. XIV.—A NOTE ON THE LARGE BROWN THRUSH (*ZOOTHEA MONTICOLA*).

I am sending you by post a skin of the Large Brown Thrush (*Zoothea monticola*,) a bird which is fairly common in the thickly wooded nullah, which extends from my vegetable garden to the top of the Binsar ridge and down which runs a perennial stream. The elevation is from 7,300 to nearly 8,000 feet. The description of the bird as given in the Fauna of India is not quite complete, for instance, no reference is made to the white webbing under the primary and secondary quills forming a broad bar nearly across the inside of the wing which is quite noticeable during flight.

In reference books to which I have access nothing appears to be recorded regarding the habits or nidification of this bird. From personal observation I believe the bird obtains its food in the bed of the nullah raking up fairly large stones with its powerful beak. It is a busy bird whilst feeding, moving back with its tail lowered when a stone is displaced, and then darting forward with its tail cocked and seizing any worm or insect exposed by the removal of the stone. The favourite hunting ground of this thrush appears to be accumulations of ooze and gravel at the base of boulders and I have frequently noticed the scratching of this bird and the probings of Woodcocks in the same places. It is a shy bird and will not brook close observation. Its flight is rapid and is more like that of a dipper than of a thrush. The flight is generally up or down stream, but when much disturbed it darts through the thick underwood and makes for the next nullah; in fact although I have observed quite a number of these birds during the past five years, I have never seen one in anything like open forest or away from the immediate vicinity of a wet well wooded nullah. The bird is not gregarious. I have never been fortunate enough to find the nest of the Large Brown Thrush, although I am convinced that it breeds here, as it remains throughout the year being certainly more common during the winter months. Some years ago, whilst upon a short visit before I had taken up my abode in Buisar; the late Mrs. Goban, a keen observer of birds, showed me a nest which she declared to be that of *Z. monticola;* the nest contained one egg, pale green, with rather pale brown blotches, the nest itself was cup shaped, neatly constructed of moss and lined with fibre and was built in the first bifurcation of a holly tree about six feet from the ground and almost touching the bank which rose steeply from the bed of the nullah. By standing on a boulder the inside of the nest was clearly observable. I suggested that the nest might be that of an ouzel, but Mrs. Goban declared she had seen the bird leave the nest which indeed had let to its discovery, and was quite certain that the bird was the Large Brown Thrush. I had to leave the next day, and so was unable to prosecute inquiries, but heard afterwards that the nest had been destroyed.

Hume in his Nests and Eggs, 2nd Edition, makes no reference to *Z. monticola,* but gives an account of a nest of the Purple Thrush taken in the same nullah by Horne many years ago, the indentification of which was obviously open to question, owing to the circumstances under which the bird was obtained and makes me wonder whether the nest was not that of *Z. monticola,* as the description of Horne's nest and eggs tallies completely with the one found by Mrs. Goban. The Purple Thrush is, at any rate, at the present time, an exceedingly rare bird. I have not seen it myself once in the past five years during which I have been a close observer of the birds in the neighbourhood, and think it quite possible that Horne mistook *Z. monticola* for *Cochoa purpurea.* However in a footnote on page 111 of Nests and Eggs the Editor states that now that the history of these Thrushes is better known, there is little doubt that Horne's nest really belonged to *C. purpurea.*

S. J. MARTIN.

BINSAR HOUSE,

KUMAON, 30*th December* 1918.

No. XV.—NIDIFICATION OF THE SMALLER STREAKED SPIDER-HUNTER (*ARACHNOTHERA AURATA*).

During June and July 1918, when camped at the foot of the Pegu Yomas, in Prome Division, at the headwaters of the Shwele River, I shot 2 or 3 specimens of *Arachnothera aurata,* the Smaller Streaked Spider-hunter, (Blanford's No. 907) and found them just ready to breed. The birds are by no means rare in this immediate locality, and distinctly conspicuous from their habit of sitting on a branch and twisting their heads, and stretching their necks, and their dumpy unbalanced figure owing to their short tails and long bills. On July 24th, I noticed one fly past my té with a thread of silk or cotton in its bill, but a long search failed to bring its nest to light. Several other hunts brought no better luck.

On July 28th, I was out doing a long day's logging. As I was walking along a rather slippery felled teak, I put out a hand on to a creeper growing beside it to steady myself. From right under my hand, an *Arachnothera aurata* flew out, and after a very short search I found its nest, containing 2 eggs. The creeper had been pushed aside 5 days before, to get at the tree to fell it, when the fellers had found the nest; luckily the bird had not deserted, but was actually sitting, when I found it, though the nest had been pushed 2 or 3 feet out of place by the tree in falling.

The nest was on the underside of a leaf of a thorny climber (*Smilax macrophylla*, I believe) common in Lower Burma, which bears thorns all over its stems and along the ribs of the leaves, which are up to nine inches or a foot in length; the local name is 'Katcho.' It was hung from the leaf by about 100 little threads of silk, each worked into the material ef the nest, pushed through the leaf, and knotted on the upperside. These threads ran all round the back and sides of the nest, but were especially numerous at two ends of the rough semicircle thus formed. On the upper surface, the semicircle of knots was about ¾" wide, and 5" in external diameter. The front was open, and the nest was so built that when the leaf was hanging naturally, there was a space of about 1¾" between the edge of the nest and the leaf in front, the back was close up against the leaf. Water was kept out of the holes in the leaf by the knots; when I found it, it had been raining heavily, but the inside was quite dry. The combined strength of the supporting threads was considerable.

The nest itself was a cup, high at the two sides and low at the back and front, made of vegetable fibre, ornamented scantily on the outside with skeleton leaves, and bits of bamboo leaf. Round the lip of the nest were several pieces of white, curly, bark from bamboo spathes, I think: these were arranged in a strip, 2" long, and ¾" down just on the outside of and below the lip.

The nest was about 2¾" across at the top, rather less from back to front, and more from side to side, of rather the conventional "watch pocket" shape. Externally, it was 2¾" deep at the front and back, and 3¼" at the sides: internally, 1⅝" deep at front and back, and correspondingly more at the sides. The internal hollow was 1¾" across from front to back, and 2" from side to side: this makes the sides half an inch, and the bottom 1⅛" thick.

It was very compactly put together, and lined with vegetable down somewhat scantily, mixed with fine fibres, the whole forming a pad at the bottom of the nest which was easily removed. The rest of the nest was entirely made of strips of brown vegetable (bark) fibres, finer towards the inside, but no where more than $\frac{1}{20}$" across, which were not felted together, but appeared to be put in one by one and worked into shape; from the inside, the nest came to pieces easily, but outside it was bound round with a few rather broader strips of fibre, which creased the outline of the nest.

The nest was about 5' from the ground, on the top of a ridge with some secondary growth round it (not dense as the soil was bad) in a patch of open jungle of mixed bamboos and small trees.

The eggs—2 in number—were fairly set, and I can match them for colour and markings from my small series of *Arachnothera magna*. In size, they are 21, and 19·75 × 15 and 14·75 millimetres (= 83·78 × 59 and ·85 inches). The colour is a sort of purple, or dark battle-ship grey with minute net-like, or crack-like marks all over them; one egg has no other markings except a faint ring of darker grey at the large end. The other egg, which is the lighter in the back ground and has a greenish tinge, has dark grey spots all over it. Both eggs are glossy and pitted, with a hard, fine grained shell rather like eggs of *Ploccella javanensis*, but not so thick.

Mr. E. C. Stuart Baker tells me that he has never seen a nest of *Arachnothera magna* as small as this, while *Arachnothera magna* and *Arachnothera longirostis* both use skeleton leaves extensively in the making of the nest, instead of fibre, as in this case.

As I believe that the nest and eggs of *Arachnothera aurata* have never been found before, I send you the above rather full description. Although

I looked carefully, I was unable to get a second nest to confirm my notes, though I found some fully fledged young birds flying about in September.

J. M. D. MACKENZIE, I.F.S., M.B.O.U., F.Z.S.

PROME, BURMA,
December 1918.

No. XVI.—THE MALABAR PIED HORNBILL (*ANTHRACOCEROS CORONATUS*) IN MIRZAPUR, U. P.

This bird is fairly common beyond a line some 15 miles or so South of the Ganges as soon as the country side has lost the character of the Gangetic Plain and there are plenty of trees ; for although found in quite open country, being strictly arboreal it must have plenty of "baghs" or large trees to act as "stepping stones." They go about in flocks and attract one's attention both from their colouring and their call. The expanded tail as the bird alights is quite pretty. When seen in the hand the bird's head has a most rakish appearance, the black feathers sticking out like the hair on the back of a school boy's head.

They are known locally as "dhanesh" and are highly prized by the local inhabitants both for their flesh and for the oil to be obtained from them.

They are distinctly wary, especially if followed up, and when opportunity occurs are invariably added to the "bag."

G. O. ALLEN, I.C.S.

MIRZAPUR, 30*th November* 1912.

No. XVII.—THE CUCKOO (*CUCULUS CANORUS*) IN MIRZAPUR, U.P.

I find the following amongst my notes :—

> I have heard this cuckoo calling a good deal lately (5th August 1912). I shot a young cuckoo not far from the Civil Station. It proved to be in the second stage of plumage, the nuchal spot being still retained (27th August 1912).

G. O. ALLEN, I.C.S.

MIRZAPUR, 30*th November* 1912.

No. XVIII.—EXTENSION OF RANGE OF THE BRONZE-WINGED DOVE.

Regarding the Bronze-Winged Dove (*Chalcophaps indica*) Blanford states in Vol. IV Birds, Fauna of British India, 1898, that the only localities in which it is found in the Madras Presidency are the Malabar Forests from Cape Comorin upwards towards Bombay. I write to state that I shot a hen of this species on 13th February 1919 in the Panapakkam Reserve Forest of this district. This was shot as the bird was entirely new to me and I could not identify it until it was in my hand. Two more of the same species were seen later but not fired at. Please let me know whether this is a new locality for the bird to be found in. I have a dim recollection that the late Mr. Roscoe Allen (Madras P.W.D.) told me in 1912 that he had shot a specimen of this species in the Mamandur forest (a continuation of the Panapakkam forest and some 20 miles distant) and had reported the same to the Society. I regret to state that my bird was too much knocked about for preservation.

H. DAWSON.

Chittoor, S.I.,
15*th February* 1919.

(This is an interesting record as apparently the furthest South this Dove has been recorded on the East Coast is inland from Masulipatam (*vide* Stuart Baker's Indian Pigeons and Doves). There is however a skin in the British Museum Collection labelled "Madras" and presented by the Rev. H. H. Baber, but whether Madras town or Presidency is meant it is impossible to say.—Eds.)

No. XIX.—HABITS OF THE PAINTED SAND GROUSE (*PTEROCLES FASCIATUS*).

I was taken this evening by a friend of mine to a spot well known to him about 20 miles South of Mirzapur where the Painted Sand Grouse came and scratched in the evening. It is a small bit of ground about 30 ft. long entirely bared of grass by these "Painters" which come and scratch there at dusk, the earth having presumably some peculiar attraction. The birds come in large numbers just at sunset and the same place is apparently used year after year. They must come from far off as I have never heard of any of these birds being shot within 10 miles or so of the place. On the occasion of my visit only two "Painters" arrived when it was getting dusk so we left. The vernacular name of this bird in this district is "Gutila titar." As to their nesting season here, young birds are generally found strong on the wing at the end of July.

G. O. ALLEN, I.C.S.

Mirzapur, 1*st February* 1913.

No. XX.—SAND GROUSE IN MESOPOTAMIA.

In his 'Corrections to the List of Birds from Fao' republished in "Miscellaneous Notes" of Vol. XXVI, No. 1 of the Journal, Mr. W. D. Cumming includes *P. exustus* with the remark that "Grouse are seen and heard flying over Fao which, with the aid of binoculars, I thought might be this bird." It would be of interest both to sportsmen and ornithologists in Mesopotamia to know if this species has been shot, South of Tekrit. Personally I much doubt its occurrence in Mesopotamia, and feel pretty sure that the birds Cumming observed, and was doubtful of, were *P. senegallus*. During a sojourn of nearly 3 years in this country I have never known of any example of The Common Sandgrouse (*P. exustus*) being brought to bag.

Barring rare stragglers the following are the only Sand Grouse likely to be met with in Mesopotamia, their status being as shown :—

P. arenarius	The Imperial Sand Grouse. A cold weather visitor in small numbers to deserts north of Amara.
P. alchata	The Large Pintailed Sand Grouse. The common resident Sand Grouse of Mesopotamia. North of Amara it occurs in vast flocks.
P. senegallus	The spotted Sand Grouse. Residents but not nearly so common as the last, except near Basra where it breeds in considerable numbers.
P. lichtensteini	(*arabius ?*) The Close-barred Sand Grouse are not probably resident.

The call notes of *P. alchata* and *P. senegallus* very usefully serve to differentiate these two species when on the wing. The former has a single "Caw" like note, the latter a bisyllabic note or chuckle.

H. A. F. MAGRATH, Lt.-Col.

Basra, *2nd February* 1919.

No. XXI.—THE BURMESE PEAFOWL (*PAVO MUTICUS*) IN THE CHITTAGONG HILL TRACTS, BENGAL.

In Vol. XXIV, No. 1, Mr. Stuart Baker mentions the above bird as being found in Gurunia and Ramoo in the Chittagong Hill Tracts. Mr. Marchant of the Provincial Forest Service informs me that the place is Garjania and that Ramoo is a sort of a petty township in the Garjania circle. He had a live specimen sent to him about 3 years ago which he liberated in the Sitakund jungles.

CHAS. M. INGLIS.

Baghowinie Fty.,
Lakeria Sarai, *10th August* 1918.

No. XXII.—NIDIFICATION OF STONE'S PHEASANT (*PHASIANUX ELEGANS*). A CORRECTION.

In Vol. XXV, No. 3, Mr. Stuart Baker mentions ten eggs he received from me which he said were laid by a hen of a pair kept in an aviary by me. He must have misunderstood me. I probably wrote that the eggs were laid in captivity. The eggs which were a part of a clutch of 5 were given to me by Mr. O. Bertling. I believe they were received by him from the late Mr. Bartlett.

CHAS. M. INGLIS.

Baghowinie Fty.,
Lakeria Sarai, *10th August* 1918.

No. XXIII.—THE GREAT INDIAN BUSTARD (*EUPODOTIS EDWARDSI*) IN MIRZAPUR DISTRICT, U.P.

With reference to the note on p. 307 of Volume XXI of the Journal that Bustard and Florican used to be found in this District, this is certainly still so in the case of the Bustard.

During the rains a few are generally to be seen on the large grassy maidans some miles to the South of the station.

I have also seen them in other localities in the district in November and in March: so presumably they breed here. It is locally known as the "dhoom chirya" no doubt from its booming call.

A friend of mine with long experience of the game birds of this district feels certain he once saw a Florican not far from the station, but it was not bagged and this bird certainly cannot be said nowadays to be found in the district.

G. O. ALLEN, i.c.s.

Mirzapur, 1918.

No. XXIV.—NOTE ON THE OCCURRENCE OF THE LESSER FLORICAN OR LIKH (*SYPHOOTIS AURITA*) IN BOMBAY.

It may be of interest to record the fact that while travelling to Parel this morning I saw on the cricket ground of the Catholic Gymkhana on the Kennedy Sea face a female Lesser Florican or Likh (*Sypheotis aurita*). The bird flew slowly across the grounds towards the Hindu Gymkhana and was quite unmistakable.

N. MARRYAT.

Bombay, *4th September,* 1918.

[A lesser Florican was reported to have been seen near Churchgate Station on 8th June 1913, *vide* J. B. N. H. S., vol. XXII, p. 631—Eds.]

No. XXV.—THE COTTON TEAL IN MALABAR.

Blanford in F. of I. Birds, Vol. IV states that the Cotton Teal (*Nethapus coromandelianus*) is rare in Malabar, also Stuart Baker in Indian Ducks says " from Malabar I can find no record of it's (Cotton Teal) Occurrence, though there is one somewhere could I only remember it." So, it may be of interest to record that I lately saw 4 specimens which were shot near here, Nelliampathy Hills, Malabar, and I am informed that they are not uncommon.

A. M. KINLOCH.

Kollengode, P. O. *via* Palghat,
South India,
1st *January,* 1919.

No. XXVI.—OCCURRENCE OF THE COMMON SHELDRAKE (*TADORNA CORNUTA*) AND THE MARBLED DUCK (*MARMARONETTA ANGUSTRIOSTRIS*) IN KATHIAWAR.

I was shooting with H.H. The Maharaja Jam Saheb at X'mas and on the 28th December we shot a nallah near Balambha, about 36 miles N. E. of Jamnagar. Among the bag was a pair of Sheldrake. They are the first I have seen in Kathiawar. They were in very fine plumage and the collar and markings down the brest and belly were of a deeper, richer chestnut brown than that depicted in the plate in Stuart Baker's Duck Book. I measured the male bird as he lay on the ground, without stretching, and he was 2 feet.

We also shot a specimen of the Marbled Duck. I could not identify it as I had never seen one before, but it was an easy task by the book. Our bag in 3 or 4 days round Balambha also included half a dozen Greylags and a few Imperial and Sindhi Grouse. Both the latter are rare visitors so far south, only met with, as a rule, when water is very scarce in Cutch and Sind.

H. W. BERTHON, Lt.-Col.

Rajkot, *8th January,* 1919.

[H.H. The Maharaja Jam Saheb of Nawanagar has kindly forwarded to us the two skins of the Sheldrake. Writing of this bird Hume says "I have it from the mouths of Indus, the Coasts of the Gulf of Cutch, from Nawanagar Kathiwar " The last-named specimen which is in the Hume Collection in the British Museum is an immature bird and was shot in December. Of the Marbled Teal Stuart Baker says it has been obtained in Cutch and the late Col. Butler shot one near Mount Abu. In the Society's collection there is a skin from the Nall shot by Mr. H. C. Wright in December 1899. In Sind this bird is not uncommon.—Eds.]

No. XXVII.—SPOT BILL DUCK IN KASHMIR.

I am writing to let you know that I shot a Spot-billed Duck (*Anas poecilornicha*), a male, here on the 7th November 1918 and have ascertained from all available sources that this is the first of the species, which has ever been seen in Kashmir.

I shot a Stiff-tailed Duck on the same day and three more on November 23rd.

D. G. OLIVER, MAJOR.

SRINAGAR, KASHMIR,
25th November, 1918.

No. XXVIII.—THE SHELDRAKE (*TADORNA CORNUTA*) IN MANIPUR STATE.

On October 27th I saw 6 common Sheldrake (*Tadorna cornuta*) 9 miles South of here. As far as I know, the common Sheldrake has only once been previously recorded in Manipur, a shikari having shot one in 1910 (*vide* my letter in Vol. XXII, No. 2 Journal). I have never seen the Common Sheldrake in Manipur before, but the Muhammadan Shikaris say they see them occasionally, though rarely. There is no Manipuri name for the Common Sheldrake, though they have names for the commoner ducks.

J. C. HIGGINS, I.C.S.

IMPHAL, MANIPUR STATE, *3rd November*, 1918.

No. XXIX.—FURTHER NOTES ON THE BIRDS OF AMBALA DISTRICT, PUNJAB.

The following are a few additions to Mr. Hugh Whistler's list as published in the "Journal", B. N. H. S., Vol. XXV, No. 4, pp. 665-681 :—

104. The Striated Babbler—*Argya earlii*, Blyth.
Common about the reeds anywhere near the canal at Jagadhri.

235. The Red-billed Liothrix—*Liothrix lutea*, Scop.
Dodsworth obtained specimens between Kasauli and Kalka in March 1913 and I saw at least two males at an elevation of 6,000 ft. on Kasauli Hill in July 1918.

260. The Fire-Cap—*Cephalopyrus flammiceps*, Burton.
I obtained a male from a small flock feeding at the top of a Sheeshum tree at Jagadhri, 4th March 1917. Probably not uncommon on migration as I have also obtained it at Ladwa, in the adjoining District of Karnal as the same season. Males were assuming the "fire cap."

328. The Indian Ashy Drougo—*Dicrurus longicaudatus*, A Hay.
Not uncommon in the cold season. The race-course is a favourite resort of this species.

405. Tickell's Willow-Warbler—*Phylloscopus affinis*, Tick.
One specimen obtained 16th March 1918.

463. The Yellow-bellied Wren-Warbler—*Prinia flaviventris*, Deless.
Common near the canal and backwaters at Jagadhri.

475. The Black-headed Shrike—*Lanius nigriceps*, Franklin.
One specimen obtained close to Jagadhri Station, 4th February 1917.

530. The Central-Asian Starling—*Sturnus porphyronotus*, Sharpe.
The only Starling I have succeeded in obtaining. Very common in the cold season.

698. The Small billed Mountain Trush -*Oreocincla dauma*, Latham.
One specimen obtained 17th February 1918, in a mango tope close to the canal at Jagadhri.

722. The Black-throated Weaver-bird—*Ploceus bengalensis*, Linn.
Obtained two specimens from a flock composed of this species and *Passer hispaniolensis* at Jagadhri.

767. The Himalayan Goldfinch—*Carduelis caniceps*, Vigors.
A single specimen in our compound in Cantonments. Its song attracted my attention, 6th February 1918.

772. The Himalayan Greenfinch—*Hypacanthis spinoides*, Vigors.
Procured a male from a small party near Jagadhri, 17th February 1918.

778. The Spanish Sparrow—*Passer hispaniolensis*, Temm.
Several specimens obtained from a flock composed of this bird and *Ploceus bengalensis.* Common winter visitor. A Jungle sparrow at this season.

789. The Reed-Bunting—*Emberiza schœniclus*, Linn.
Probably a regular winter visitor, a few being seen almost every season. A male and female procured near Jagadhri, 17th February 1918.

790. The Grey-headed Bunting—*Emberiza fucata*, Pall.
A male procured from a small party 8 miles from Cantonments, 17th March 1918.

800. The Red-headed Bunting—*Emberiza luteola*, Sparrm.
This species was found in large numbers near Cantonments, 10th March 1918, when I procured a male and female.

A. E. JONES.

SIMLA, 17*th October*, 1918.

XXX.—LIST OF BIRDS OBSERVED IN THE EUPHRATES VALLEY.

A short while ago I was looking at a printed list of birds, etc., found in this country, published by the Bombay Society in 1916. I enclose a typewritten list of birds we have seen in this country, most of them I have seen myself. Probably many others with a greater knowledge of the subject than we have, have sent you lists. There may be some not reported before in the list enclosed. I also send you a list of wild flowers found at Khan Baghdadie and immediate neighbourhood.

LIST OF BIRDS OBSERVED IN THE EUPHRATES VALLEY.

House Sparrow.	Very numerous in all towns and villages. They are a d—d nuisance in our gardens.
Rook.	Large flock appear in the Euphrates valley during the Winter months.
Jackdaw.	Many were seen above Hit in March and April. They were evidently breeding and had nests on the cliffs by the river.
Magpie.	Several pairs were observed nesting at Hit in March. At Anna a very large colony of these birds was observed.
Blue Jay or Indian Roller.	Not uncommon throughout Euphrates Valley.

White-eared Bulbul.	Common at Nasiriyah and on the lower reaches of the Euphrates. Its song was constantly heard in Spring.
The Sharmar or Persian Nightingale.	Seen and heard in the same districts as the Bulbul.
Sedge Warbler.	Constantly observed along river banks.
Dartford Warbler.	Two of these were seen on Ramadi Grass Farm in July.
Lesser Grey Shrike.	Seen at Nasiriyah and Ramadi.
Golden Oriole.	A pair seen at Nasiriyah in March 1916 and another pair in September in the garden of D.H.Q., Ramadi.
Lesser Whitethroat.	Seen at Ramadi, July, August, September.
Common Starling.	Large flocks collect in Winter months.
Wheater and Dessert Wheater.	Frequently seen in Euphrates area.
Persian Robin.	Do. do. do. do.
Common Swallow.	Do. do. do. do.
House Martin.	Do. do. do. do.
Sand Martin.	Do. do. do. do.
Redstart.	Seen at Ramadi, August, in D.H.Q. Garden.
Yellow and Grey Wagtail.	Do. do. do. do. do.
Nightjar.	Do. do. do. do. do.
Little Owl.	Do. do. do. do. do.
Large Crested Lark.	Very plentiful throughout Mesopotamia. A nest with eggs was found on the Government Garden, Ramadi, June 1918.
Large or Common Bee-Eater.	Common in Mesopotamia during Summer months. It was observed to nest in sandbanks near Nasiriyah.
Persian Hooded Crow.	Seen at Nasiriyah and Ramadi.
Hoopoe.	Frequently seen at Nasiriyah and Ramadi.
Pied Kingfisher.	Common on Euphrates.
Indian Common Kingfisher.	Do. do.
White-breasted Kingfisher.	Seen in early Spring at Nasiriyah, and all through the hot weather.
Kite.	Occasionally seen as far North as Ramadi.
Pale Harrier.	Frequently seen near Ramadi and further North. This bird on more than one occasion was responsible for the death of pigeons belonging to the Carrier Service.
Common Buzzard.	Seen at Hitia, April.
Sparrow Hawk and Kestel.	Seen nesting at Khan-Baghdadi, March.
Ring Dove.	Breed freely in all palmgroves along Euphrates Valley.
Stock Dove.	Heard occasionally at Nasiriyah and Ramadi in the Spring.
Rock Dove.	Observed building at Khan-Baghdadi in April 1918.
Black Partridge.	Not uncommon along Euphrates Valley.
Chakor.	A pair seen on hills above Hit in April.
Seesee.	Several pairs were observed to breed round Hit. 6½ brace were shot below Hit, 3rd October 1918.
Common Quail.	Seen on Ramadi Grass Farm in August and in several other places.

Macqueens Bustard or Houbara.	Several of these birds were seen near Hit in March and April. 2½ brace were shot there on the 2nd October 1918. Some also have been shot at Ramadi.
Moorhen, Water Rail and Coot.	Common in the marshes of the Euphrates.
Purple Moorhen.	A specimen was caught in the D. H. Q. Garden at Ramadi, September 1918.
Common Sand-piper, Redshank and Greenshank.	Not uncommon.
Common Snipe.	Met with throughout Euphrates Valley. Observed to be very abundant along Euphrates old Channel, December 1915, and on borders of Hammar Lake.
Common Gull.	Seen as far North as Hit. Collects in flocks during Winter months.
Paddy Bird.	Seen at Nasiriyah and Ramadi. A Pale Harrier was seen to have killed one of these near Jackson's House on the Habiniyah Escape (Habiniyah Escape is at Ramadie), October 1917.
Commorant, Pelican and White Stork.	Were seen in large numbers on Butaniyah Lake near Nasiriyah, January 1916. Also in the Habiniyah Lake near Ramadie.
Common Heron and Night Heron.	Seen and heard at Ramadi.
Brahminy Duck.	Several seen and shot, Ramadi, December 1917. Golden Eye and every kind of duck are abundant.
Imperial Sandgrouse.	Found in large numbers throughout Mesopotamia.
Common Sandgrouse.	Do. do. do.
Linnet.	Flocks of these birds were seen on Ramadi Grass Farm in September 1918.
Plover.	Not uncommon throughout Euphrates Valley.

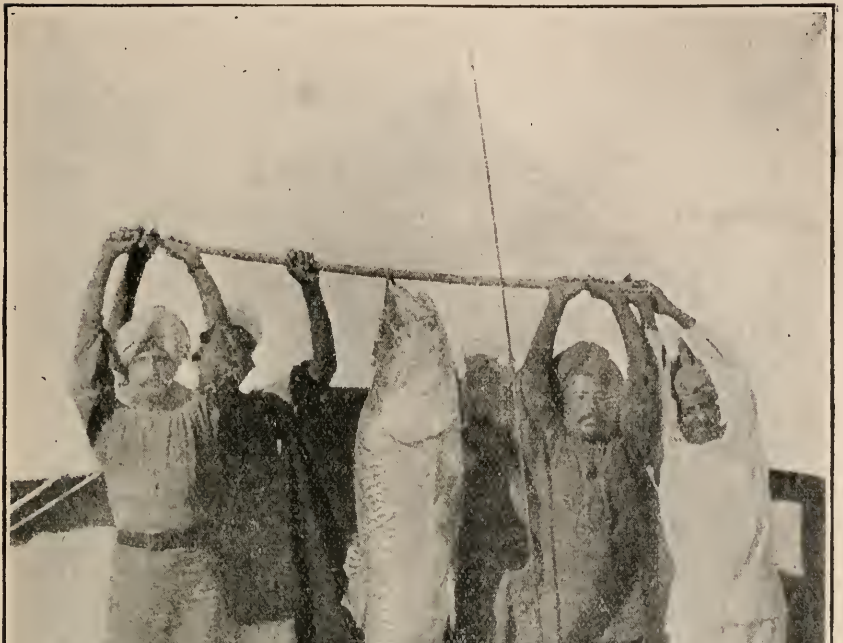
LIST OF WILD FLOWERS FOUND AT KHAN BAGHDADI, *April* 1918.

Daisy (White & Yellow).
Iris.
Orchid.
Fumitory.
Poppy (Red & Purple.)
Pimpernel (Blue & Red).
Hawk Weed.
Dandelion.
Salvia.
Campion.
Silene.
Wild Mustard.
Yarrow.
Grape Hyacinth.
Forget-me-Not.
Hounds Tongue.
Plantain.
Burdock.
Toad Flax.
Vetch.
Thyme.
Stonecrop.
Thistle.
Dead-Nettle.
Pink.
Rock Rose.
Corncockle.
Mulein.
Rock-Cress.
Saxifrage.
Cranesbill.
Persicarius.
Trefoil.
Marigold.
Woodruff.
Wild Aster.
Sorrel.
Night Stock.
Lungwort.
Feverfew.
Sanfoin.
Ragwort.
Figwort.
Maidenhair Fern.
Eyebright (Veronica).
Chickweed.
Mignonette.
Mesambryanthemum.
Cuckoo-Pint.
Spurge.
Sandwort.
Adonis.
Agapanthos.
Mallow.
Garlic.
Parsley.
Medick.
Ragged Robin.

15th Division, Mesopotamia,
8th October 1918.

H. T. BROOKING,
Maj.-Genl.

No. XXXI.—LARGE CARP FROM MESOPOTAMIA.

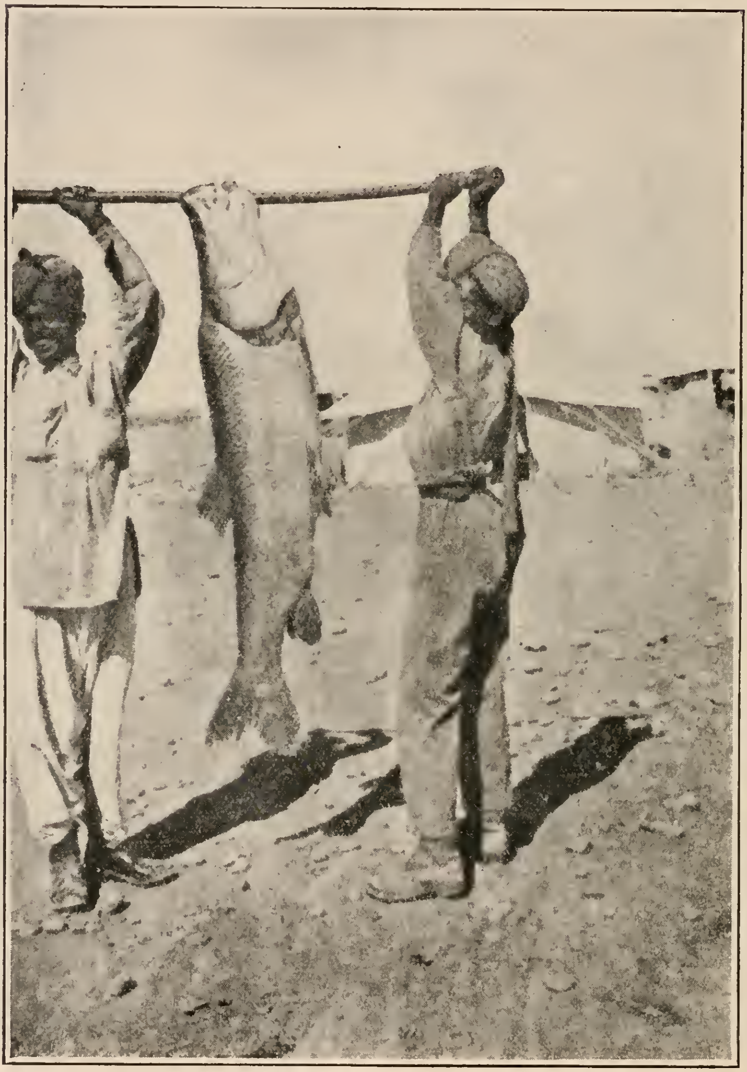


I enclose a photo which may be of interest. It is that of what is possibly the largest fish caught on a rod and line out here. It was caught by Major H. L. Colan, I.A., in the Diala River in September, the bait being atta. It was 69″ long (measured along the curve of the back) 38″ girth, and weighed 123 lbs. The rod was a 14 ft. one and not a heavy one as may be seen in the photo and the fish took 1½ hours to land.

MESOPOTAMIA,
12*th October* 1918.

R. BAGNALL, MAJOR,
74th attd. 67 Punjabis.

No. XXXII.—LARGE CARP FROM MESOPOTAMIA.



I enclose a photo of a 96 lb. fish caught in the Diala near Qizil Robat at the beginning of the month—caught on a lump of atta.

MESOPOTAMIA,
19*th October* 1918.

H. MACKAY,
BRIG.-GENL., R.A.

No. XXXIII.—THE HABITS OF THE TREE FROG (*RHACOPHORUS MACULATUS*).

I watched a little tree frog that twice came on to the table in the verandah in the evenings to make a meal off the insects attracted there by the lamp.

He looked very thin and was very stolid, only moving when something edible came pretty close. The attitude he adopted was comical: folding his "arms" close under him and sitting in a most "collected" posture as if he was going to make a mighty leap. He let all sorts of insects crawl over him only objecting when they stopped too long in his eye; he would then wipe them off lazily with a front leg. He only ate things if still alive. I caught some insects and after incapacitating them put them in front of the frog but he would not pay any attention to them unless they still moved: when he speedily devoured them.

The projection of the tongue is a curious sight: it looks as if half the animals inside was coming out of the huge gape! The tongue is covered with some gummy substance which adhered to the table cloth. He appeared several times to shoot out his tongue and leave this sticky mess on the table when there was nothing there to catch: perhaps he was merely "bird liming" the space in front of him to stop an unwary passer-by. I was anxious to see if he would touch a "geranium bug" (*Cydnus indicus*) and was most surprised to see him take two or three: they must have been very satisfying or did not agree with him as he left soon afterwards jumping off the table on to the vertical back of a chair, a characteristic feat. Perhaps this diet accounts for his thin appearance! I see E. H. A. remarks "their aspect was always famine stricken and angular."

G. O. ALLEN,
DEHRA DUN.
19-1-19.

MIRZAPUR, U. P.,
10*th October* 1912.

No. XXXIV.—THE HABITS OF *DRYOPHIS MYCTERIZANS*.

The other day I came on a large *Dryophis mycterizans* in the act of swallowing an Earth Snake—a species of *Sylibura*. On my going up close the *Dryophis* disgorged the portion of the *Sylibura* that was down its throat and made off, as did the latter, apparently none the worse for the ordeal! Have any other members of our Society noticed *D. mycterizans* eating other snakes?

A. M. KINLOCH.

KOLLENGODE P. O. *via* PALGHAT, S. I.
1*st January* 1919.

No. XXXV.—THE BITE OF THE LARGE SPOTTED VIPER (*LACHESIS MONTICOLA*).

The following may be of interest to you. A boy about twelve years old was brought to me on the 7th instant, and he and father both stated that a snake had just bitten the boy. Their house is quite close, and could not have taken more than 10 minutes for them to come to me, and they declared that they had come at once. I found a puncture on the first finger of the right hand where the boy said he had been bitten, and on squeezing a little blood showed. I incised the wound well with a Laudor-Brunton lancet and rubbed in Permanganate of Potash Crystals for some minutes with ligature above wrist. The boy only complained of some pain up as far as shoulder, but this may have been the effects of the ligature. He was alright next morning. I sent at once for the snake which they had killed, and it proved to be a *Lachesis monticola*. About 15 inches long, it was under a stone which the boy was removing.

A. WRIGHT.

GYABARI, D. H. RY.,
10*th October* 1918.

No. XXXVI.—REMARKS ON COL. WALL'S IDENTIFICATION OF *HYDROPHIS CYANOCINCTUS*.

In the last number of this Journal (XXV. 4, p. 754), Col. Wall has given details of some sea snakes—a gravid female and four others—which I sent to the Society's Museum about two years ago. At the time they were identified by me as *H. tuberculatus*, Anderson. Col. Wall now states in his article that he considers them to be *H. cyanocinctus*, a diagnosis with which I cannot agree at all.

It is now nearly six years since I obtained the first specimen of this snake, and being then unable to identify it with any description, sent it to Mr. Boulenger for his opinion.* He considered it to be *H. tuberculatus*, but as far as I am aware he had no specimen for comparison, the type and only one then known being in the Indian Museum. What is evident, however, is that he did not consider it to be *cyanocinctus*, and this view was confirmed later in a second specimen. (Jnl., Nat. Hist. Soc., Siam., I.4.247). Col. Wall on the other hand who has examined the type of *H. tuberculatus*, has pronounced it to be an undoubted *cyanocinctus* (*vide* Monograph, p. 220).

I very naturally therefore wished to examine this type for myself, and last year through the kindness of Dr. Annandale I was able to do so. I had no hesitation in agreeing with Col. Wall that it was a *cyanocinctus*. At the same time I felt equally sure that my own snake was not, and being therefore unknown to science I described it under the name of *H. siamensis*.†

I had then a large series of them, together with typical *cyanocinctus*, for comparison, both species being common in the Gulf of Siam. Col. Wall's article is dated December, and at the time he wrote if he could not have seen my description. In any case he could not have known I had renamed the snake, as in my preliminary notice I have given no synonymy.

Col. Wall has given eight reasons to support his diagnosis and I will take them in their order. With Nos. 2, 3 and 5 I agree, but that fact does not in any way influence my decision.

"1. Because the number of the costal rows accords with the range given in Boulenger's description in his Catalogue, Vol. III, p. 295."

I cannot follow Col. Wall in his argument here. The range given by Boulenger is 27 to 33 round the neck, 39 to 45 round the body. Yet the range recorded by Col. Wall for my 13 specimens is, 31 to 35 round the neck, 35 to 39 round the body; 39 in fact, Boulenger's minimum count, is reach only 3 times in the series.

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* This specimen is still in the British Museum of Natural History.

† Preliminary diagnoses of four new sea snakes—Jrnl., Nat. Hist. Soc. Siam. II, 4, p. 340, Dec. 1918.

"4. There is nothing in the lepidosis of the head by which they can be considered distinct."

Again I quote Boulenger. "Frontal much longer than broad, as long as its distance from the rostral or the end of the snout" and later "two superposed anterior temporals." In my description of *H. siamensis* I have given, "frontal as long as or shorter than its distance to the rostral" and "normally a single anterior temporal"; and in a series of 33 specimens the frontal is shorter than its distance to the rostral in 22, or 66 per cent. of them, and although a single anterior temporal appears to be normal, fragmentation of that shield on one or both sides occurs in 11, or 33 per cent., of the specimens. Such differences as these were they to be found only in one or two examples might be rightly viewed with suspicion, but where they are to be found frequently over a large series they are surely entitled to recognition.

"6. The dentition agrees with that of my Indian specimens and is as follows:—The postmaxillary teeth vary from 7 to 10 (Indian specimens 6 to 10)."

This is not in accordance with Col. Wall's previous remarks on *cyanocinctus* (*antea*, XXIII, 2, p. 375). There he says, the postmaxillary teeth are usually 7 in number, sometimes 6, in one 8. My 5 skulls of *cyanocinctus* from this region agree entirely with his original figures, whereas in 6 skulls of *siamensis* the teeth are 8 and 9, in one doubtful 10.

Finally there is the question of length and colouration (7 and 8). The length of *siamensis* (my series includes 7 gravid females) does not exceed 1000 mm. *Cyanocinctus* on the other hand attains a much greater length. Boulenger gives it up to 1,500 mm., but my largest specimen measures 1,885 mm.

Siamensis is greenish-grey above, with dark grey complete bands. The head is dark grey or black, with yellow markings along the sides and across the snout. Both bands and yellow markings tend to disappear in old age. Of my 21 examples (adult and half grown) of *cyanocinctus* from this region, none is completely banded. They are boldly marked with blue black dorsal bars, which as with *siamensis* disappear with age. The head is oliveaseous or yellowish, and without the defined markings of *cyanocinctus*.

In considering therefore that my specimens were not *H. tuberculatus*, I agree with Col. Wall, for we are both of the opinion that that name should be a synonym of *cyanocinctus*. But that my *siamensis* is also a *cyanocinctus* I most strongly contest. In fact I find them so different that I should not have thought it possible for them to be confused.

MALCOLM A. SMITH, F.Z.S.

BANGKOK, *August* 1918.

No. XXXVII.—NOTES ON SOME INTERESTING SNAKES RECENTLY PRESENTED TO THE SOCIETY.

Ablabes pavo, Annandale.

The Society has been fortunate in securing a specimen of this handsome snake, which has hitherto been only known from the Abor Hills, where a single example was obtained on the Upper Rotung, by the 32 Sikh Pioneers while road making. It is described by Dr. Annandale in the Zoological Results of the Abor Expedition. (Records of the Ind. Musc. Vol. VII., pt. 1. Plate.) The present specimen was obtained at Kindat, Chin Hills, Burma, by Mr. J. M. D. Mackenzie. The scale characters agree with Dr. Annandale's description of the Abor specimen; on the present species the 3rd supralabial on one side is divided giving off a small scale wedged in between the 2nd and 3rd labials. There are 224 ventrals and 72 sub-caudals. Length 362 m.m. Tail 68 m.m.

The colouration is strikingly handsome and has been rightly described by Annandale as a magnificent species.

Calamaria pavimentala.

The specimen was presented by Mrs. Jackson, and was obtained at Tura on the Gaw Hills, Assam. The lepidopsis agrees with the description in the fauna of British India. *Reptilia*, p. 282, except in the number of ventrals which is 186 in the present species.

The coloration is a deep iridescent brown above each scale having a lighter mottled centre. The lops are yellowish speckled with brown. The belly is uniform yellow. The pair of yellow spots at the base and another at the end of the tail mentioned by Boulenger are not in evidence in the present specimen.

The marking of the sub-caudals with a dark median line is in agreement with Burmese and Javan forms. The finding of this snake in Assam definitely establishes a record; its occurrence there being hitherto regarded as doubtful.

Bungarus cœruleus, color variation.

The snake was presented by Major Shaw, it was taken at Yerawda Poona.

It is distinguished by the complete absence of the white transverse arches which characterise the coloration of the species.

The whole dorsal region is a uniform deep purplish brown, as in *Bungarus lividus.*

On close examination a trace of white may be recognised in two faint irregular longitudinal lines along the flanks formed by the lower borders of the 4th and sometimes 5th transverse row of costals being edged with white.

These lines are not apparent except in close inspection. They are more in evidence on the mid-body and are completely absent on the tail.

Bungarus cœruleus. An abnormal specimen.

The specimen was presented by Capt. C. M. Ingoldby, R.A.M.C., and was taken by him in Jullundur, Punjab. The enlargement of the median row of scales so characteristic of the krait is in the present specimen repeatedly interrupted by the breaking up of the median scale into or sometimes 3 separate scales.

The lepidopsis is quite normal till the 48th transverse row of costals is reached here. The median enlarged scale breaks up into 3 scale 3 giving off an extra right and left lateral scale and converting the row into one of 17 instead of the normal 15 scales. The next transverse row is again normal and is followed by one containing 16 scales; in this instance the median scale only breaks up into two, giving an extra scale to the laterals on the right side. Continuing we find the costals arranged in an alternating series of 16 and 17 scale rows with an occasional return to the usual series of 15 rows, this arrangement persisting throughout the entire length of the snake.

In the rows where the costals number 17, the median scale is equal to or sometimes smaller than the laterals; when the number is 16 the enlargement is somewhat maintained.

The arrangement, size and number of the costals being an important feature in the identification of the kraits, this instance of a departure from the normal is perhaps worthy of a record.

S. H. PRATER.

Bombay Natural History Society's Museum,
January 1919.

No. XXXVIII.—THE UNDESCRIBED FEMALE OF AN INDIAN DRAGONFLY, *HEMICORDULIA ASIATICA*.

Whilst looking over a small collection of dragonflies sent to me from Pusa by Mr. Bainbrigge Fletcher, I was pleased to find a pair of the very rare dragonfly, *Hemicordulia asiatica*, Selys, the female of which has hitherto been unknown. Only two specimens of this insect are known, both males, one in the Selys collection, which has been probably looted or destroyed by the Germans and another which was taken by Mr. Stevens in the Abor Expedition. The former specimen was taken in the Khasi Hills, the latter at N. Lakhimpur, Upper Assam, whilst the Pusa pair were taken in Shillong.

The ♂ and ♀ are much alike, differing only in the shape of the wings and abdomen ; the following is a description of the ♀. Head ; eyes green ; vesicle, frons and upper epistome metallic green, lower part of epistome, the labrum and labium bright yellow.

Prothorax brown with a large, dorsal, yellow spot.

Thorax metallic green, with two broad, bright yellow stripes on the sides, one post-humeral and the posterior one involving the whole of the metepimeron. Legs black marked with yellow.

Wings clear hyaline, thus differing from those of the male which are a little smoky. The anal angle (tornus) rounded. Hind 35 mm.

Abdomen. Segments 1 and 2 dorso-ventrally dilated, segments 1 to 5 compressed laterally, the remainder strongly depressed, 7 to 9 moderately dilated. Length 32 mm. Colour black marked with yellow along the sides, the first 3 segments by a continuous fascia, 4 to 8 with elongated spots which reach the base of each segment. The dorsum of the first 2 or 3 segments metallic green.

Genital organs. Distal border of the 8th ventral plate prolonged as two small foliate processes, the 9th with a poorly developed vulvar scale, not overlapping the 10th.

F. C. FRASER, MAJOR, I.M.S.

BOMBAY, *Jan. 28th*, 1919.

No. XXXIX.—*LIBELLULINES* AT ST. THOMAS' MOUNT, MADRAS.

The following notes were made as the result of several excursions, during the months of February and March, of this year, in the neighbourhood of St. Thomas' Mount, Madras. No notes, so far as I am aware, have hitherto been published of the species of the *Odonata* occurring in this locality. These notes deal only with the *Libellulines*, but I hope to publish a list of some of the other families found in this neighbourhood. The nomenclature is that used by Major F. C. Fraser, I.M.S., in his articles on Indian Dragonflies now appearing in the journal.

Tanks and wells were full in February around the Mount, and the weather was cool and pleasant. Towards the end of March however the weather began to grow unpleasantly hot, and the water-level in the tanks had fallen about six to eight feet. The change seemed to make no difference in the number of dragonflies about. Dragonflies were numerous throughout the months of February and March, but the number of species was not large. Larvæ appeared to be maturing constantly as juvenile forms, of almost all the species taken, were found throughout the period.

The following is a list of species found.

Orthetrum sabina	very common.
Diplacodes trivialis	,, ,,
Diplacodes nebulosa	scarce*
Trithemis pallidinervis	common.
Trithemis aurora aurora	very scarce.
Trithemis aurora aurora juv	,, ,,
Crocothemis servilia	common
Zyxomma petiolatum	,,
Brachythemis contaminata	very common.
Brachydiplax sobrina	scarce.
Potamarcha obscura	common.
Pantala flavescens	,,
Indothemis caesia	scarce.
Bradinopyga geminata	common.
Rhyothemis varieagata	,,
Rhyothemis phyllis	one female.
Acisoma panorpoides panorpoides	common.
Tholymis tillarga	,,
Tramea Limbata	only one specimen seen, not taken.

By far the commonest species were *Orthetrum sabina* and *Diplacodes trivialis*. It would be difficult to tell which was the more common. The former swarmed in the hedges and shrubs, while the latter seemed to prefer the grassy spots of the "*maidans*" and the sides of roads. Hardly a square yard of the grassy plains around the Mount were free of *D. trivialis*. None were found over water. The females were more numerous than the males, which latter when mature are exceedingly active and difficult to catch. Colour changes due to maturation are very marked in this species, the full grown male being a handsome insect of a dark slaty blue frosted over, while the juveniles are of a pale yellow with scarcely any markings. All gradations between the pale yellow and the fully matured slate-blue insect were taken, the colour contrast is very striking.

Associated with *D. trivialis,* and like it, a very low flying insect, a few specimens of *D. nebulosa* were taken. This insect was very scarce and the adult male is even more active than *trivialis.* Females were somewhat more common than males.

In common with several other species of Odonata, *O. sabina* is at times markedly gregarious. Its distribution on these occasions is very local. Small areas can be found swarming with it to the exclusion of other species. In one plot of ground, during the month of March, they could be taken 3 or 4 at a time with each sweep of the net. This little plot of ground was not more than twenty yards square. I noticed the same thing in connection with *R. varieagata.* In all my excursions in this neighbourhood I saw only one specimen of this tribe (*Rhyothemis*), flying high in the gardens of the Agri-Horticultural Society, Mount Road, Madras. The Chetpat Railway station, however, literally swarmed with these beautiful insects. They even flew into the railway carriages. I took several pairs on the platform, but on searching the fields and tanks around the station I failed to see a single specimen. The station employees could give no information as to whether they appeared there every year; in fact they had not noticed their existence until questioned, in spite of the extraordinary numbers present.

Another species, with similar local habits, is *B. geminata.* Large numbers can be taken off the north wall of the Church of England cemetery, St.

Thomas' Mount, and the ruins of the ancient Roman Catholic Church, near the Butt Plain in the same locality. They seem to have a particular liking for cemeteries, as large numbers can be taken in St. Mary's Cemetery, Madras. The stone gray colour of this insect seems to match well with discoloured walls and tombstones. I have never taken any in shrubbery or grass, always on rocks, stone walls, or buildings of sombre colour.

The banks of the river Adyar, which runs west of the hill, were worked several times but the results were disappointing. Large numbers of *B. contaminata* were found. These insects were never seen away from water, and are to be found all along the river banks as well as in nearly every well in the place.

T. pallidinervis was fairly common. Only two specimens of *T. aurora aurora juv* were taken. These last must be more numerous and it is possible that the particular locality favoured by them was not discovered. The colour changes due to maturation are very well marked in *T. pallidinervis.* The adult insect has a robust maroon thorax, while in the juvenile the thorax is a pale yellow.

Two species, fairly common in the wells around the Mount, are of special interest. They are *Z. petiolatum* and *T. tillarga.* These flies appear to be almost exclusively "night fliers" or more correctly "twilight fliers" as no specimens were seen flying or feeding by day. A few specimens of *T. tillarga* were beaten up from a dense growth of cactus during the afternoon, but their movements were sluggish, and showed nothing like the same activity they evince after sundown. They appear to leave their shady haunts about sunset. The 30 or 40 minutes of dusk which intervenes before complete darkness is a busy period for them. I never observed any of these insects seated at this time. They spend the time on the wing in extraordinarily swift flight over water, in wells or tanks, or over the tops of trees and bushes, feeding greedily on the swarms of mosquitoes and other small insects, which seem to awaken to life at this time. The eyes of specimens of both species, when examined fresh, are of a singularly rich olive green quite unlike the eyes of other species of *Libellulines.* It is possible that this feature in conjunction with the peculiar conformation of the vesicle, as pointed out by Captain F. C. Fraser, I.M.S., may be of some special service to it in its night-flying habits.

Another interesting feature with regard to *Z. petiolatum* is the unusually delicate nature of its limbs, an abdomen. It is possible that the nature of its prey may have something to do with this. Its facies is almost mosquito-like in appearance, if due allowance is made for its size.

The male of *C. serviliæ* occurs in two distinct colourations. One a bright scarlet with delicate frosting, and the other a dusty yellow. Mature specimens of both types were taken.

P. flavescens were not numerous at this time of the year, but I believe they have been known to swarm over the Butt plain at the beginning of the rains. A high flying insect, it hovered chiefly around mango trees apparently feeding on the little mango flies, always to be found among the leaves of these trees at this time of the year.

On the whole dragonflies were numerous, but the number of species found was disappointingly small.

* Since writing the above Captain Fraser has found that *D. nebulosa* was common around Madras in June. They were plentiful over marshy ground. I might add that the few specimens taken by me were also

found in a marshy spot. *O. sabina*, on the other hand, found swarming in February and March; was scarce in June.

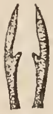
H. R. RISHWORTH.

H. S. "MADRAS,"
5th September 1918.

No. XL.—A NOTE ON THE FUNCTION OF THE "FORCEPS" IN *FORFICULIDÆ*.

In Maxwell-Lefroy's "Indian Insect Life" on page 52 the function of the forceps carried by earwigs is discussed. "The function of the forceps" says the author, "is a mystery that will be cleared up only when their food habits and general life are better understood. It has been suggested that the forceps, though not actual weapons of defence, appear as such and give the insect a more formidable appearance which protects them against the enemics that occur in their habitat, etc.

While at Amara in 1916 during the late summer months, large numbers of earwigs used to appear nightly round the tent lamps and run about the table during meals. This species had a very long pair of forceps shaped rather like the mandibles of the stag beetle.



Diagrammatic and drawn from memory.

I sent several specimens to the Bombay Natural History Society, but have not heard if they have been identified. On more than one occasion I have seen them deliberately seize a small moth with the forceps and hold it firmly and then run away with the victim to some sheltered place. In one instance I saw the earwig bend its tail towards its mouth and start nibbing at the captive moth. In no case, however, did I actually see an earwig devour the whole of its prey—they are restless and active creatures and generally escaped from observation in a short time. Had I known the interest of the subject, it would have been easy to have observed their habits more closely when kept in captivity.

I called the attention of several others to the predatory habits of this species of earwig and I would be very interested to know if this habit has been noted by other observers in Mesopotamia or elsewhere.

F. POWELL CONNOR, LT.-COL., I.M.S.

BASRA, *December* 1918.

[In the introduction to the Volume on *Dermaptera* (Earwigs) in the Fauna of British India series, Mr. Malcolm Burr gives some interesting notes and extracts on the use of the forceps. It appears that the forceps are useful weapons in attack and defence, but are never used in copulation. Occasionally they are used to help to fold and unfold their wings and lift up their elytra. In attacking an insect an earwig either waits till it passes or siddles up to it sideways till within reach when it shoots out its abdomen to the side and seizes its victim by the forceps then transferring it to its mouth. Sometimes the prey is continued to be held in the forceps while being eaten and if disturbed the earwig runs away with its victim still impaled between the forceps. It is regretted that we have not been able to have the earwigs identified yet.—EDS.]

No. XLI.—SOME BUTTERFLIES TAKEN IN BENARES, AND ADJOINING DISTRICTS.

The following list is compiled from fairly continuous collecting in spare time over a period of eighteen months (1916-17) spent chiefly in Jaunpur. About five months of the time I was posted at Benares and also spent a week at Xmas in Mirzapur.

Benares from a butterfly collecting point of view presents few features of interest, the district being almost entirely under cultivation and my collecting was practically confined to the " Company Bagh."

Jaunpur, an adjoining district on the N. W. side, is equally uninteresting and my hunting ground consisted of my own and neighbouring compounds.

The part of Mirzapur (which lies to the S.-W. of Benares), where I was camping, is entirely different and consists mostly of scrub jungle and stony waste land with scattered villages.

The list is no doubt incomplete, but probably includes most of the commoner species.

Nymphalidæ,

Danais limniace, Cr.	Common particularly in July and August at Duranta flowers.
,, plexippus, L.	Fairly common during the rains.
,, chrysippus, L.	Common at all times.
Euplœa core. Cr.	Common at all times especially during the rains at Duranta flowers.
Ypthima hubneri, Kir.	Saw one or two Ypthima, probably this species, in grassy scrub jungle in Mirzapur district at Xmas. Took a d.s.f. specimen in Jaunpur on 22nd June and saw a w.s.f. on 4th July.
Mycalesis perseus, Fal.	Common from August to November.
Melanitis ismene, Cr.	Very commonly seen in the rains at dusk under big trees. Found one attracted in the daytime to Duranta flowers. They were particularly attracted by the ripe fallen fruit of the Phalsa (*Grevia asiatica*) and while feasting were at the same time in deep shade.
Euthalia nais, Forster.	Saw one or two at Xmas in Mirzapur sunning themselves on the paths in scrub jungle. Saw a newly emerged specimen at Jaunpur on 22nd June feeding on the Phalsa fruit and took a damaged one at sunflower on 5th July. An alert species.
Neptis eurynome, W.	A few noticed in Benares in November. Also seen on 5th July.
Junonia lemonias, L.	Common.
,, hierta, Fab.	Not common. Chiefly seen in November, when it was much attracted by the little mauve flowers of *Justice diffusa*, a common weed.
,, orithyia, L.	Common.
,, atlites, Joh.	A single specimen seen on 19th February 1917 in the garden in Jaunpur.
,, almana, L.	Common : particularly the w.s.f. in September.
Vanessa cardui, L.	Not common : an odd one seen in December and in February.
Hypolimnas bolina, L.	Very common at Duranta in the rains.

Hypolimnas misippus, L.	Plenty of males at Duranta in August, but females not seen till November and then not common.
Atella phalantha, Drury.	Common in July and early cold weather.
Telchinia violæ, Hub.	Found this pretty common in Mirzapur at Xmas in damp semi-dried up " bunds " where there were still a number of small flowering plants: took a couple in Jaunpur in July.
Cethosia cyane, Drury.	Secured the only one I saw in Company Bagh, Benares, at Duranta on 4th July 1916.

Nemeobidæ.

Abisara echerius, Stoll.	Saw several in the jungle in Mirzapur at Xmas.

Papilionidæ.

Papilio aristolochiæ, Fab.	Common in rains at Duranta.
,, clytia, L.	(Dissimilis.) Saw three at a Duranta hedge on 9th July in Jaunpur.
,, demoleus, L.	Abundant especially in rainy season.
,, polytes, L.	Common in rains and early cold weather: cyrus and polytes forms of female found, but only a single much damaged romulus.
,, nomius, Esp.	Took a perfect specimen on 6th July 1916 at Duranta hedge in Benares : saw two more next year on 24th June in Jaunpur.

Pieridæ.

Leptosia xiphia, Fab.	Common at Benares in November: not seen at other times.
Delias eucharis, Drury.	Abundant at most seasons of the year.
Anaphæis mesentina, Cr.	Found freshly emerged insects common in Jaunpur in April.
Huphina nerissa, Fab.	Fairly common in rains; found several phryne forms in December attracted by the flowers of *Lanthana camara.*
Ixias pyrene, L.	Common : mostly in November, but also seen in December and January and up to April. Not seen at all at other times.
,, marianne, Cr.	Common : almost all the year round, especially in the rains.
Catopsilia pyranthe, L.	Fairly common in July.
,, florella, Fab.	Seen most often in November.
,, crocale, Cr.	Very common in the rains at Duranta.
,, pomona, Fab.	Fairly common in July. I found the Catopsilias did not put in an appearance at the flowers till the sun was getting hot about 9 a.m., whereas *D. eucharis* and *E. core* were always to be found from sunrise.
Terias libythea, Fab.	Fairly common in the rains.
,, venata, M.	Taken in the rains but not common.
,, læta, Bdl.	Fairly common in November in Benares.
,, hecabe, L.	The commonest of this genus, especially in the rains. The ♀ is slightly larger than the ♂ and on the underside of the ♀ the hind wing is a paler yellow than the forewing.
Pareronia hippia, Fab.	Fairly common in November in Benares: very partial as were the Catopsilias and others to the prickly bushes of *Lantana camara.*

Lycœnidœ.	
Chilades laius, Cr.	Common amongst the lime bushes in July and August. The ♂ much commoner than the ♀.
,, trochillus, Frey.	Common at the wild indigo from June to August.
Zizera maha, Koll.	Common at most seasons.
,, gaika, Fab.	Taken in July.
,, lysimon, Hub.	Do.
,, otis, Fab.	Do.
Everes argiades, Pall.	Saw what I am practically certain was one of this species on 6th July in Jaunpur.
Catachrysops strabo, Fab.	Fairly common in November: also taken in April
,, cnejus, Fab.	An odd one taken in November and also in July.
,, pandava Hors.	Not certain of this. One specimen is noted as taken in Jaunpur and it is very likely to be found here.
Tarucus theophrastus, Fab.	Taken in March and several in July and Aug.
,, plinius, Fab.	Taken in December: common in middle of March and also in July by the lime bushes.
Lampides bochus, Cr.	A single ♂ taken at Jaunpur on 16th August at Duranta.
Polyommatus bœticus, L.	Very common in Jaunpur at beginning of March.
Deudoryx epijarbas, M.	Not common: taken in April in Jaunpur.
Castalius rosimon, Fab.	Only found early in July: Jaunpur.
Hesperiidœ.	
Telicota dara, Koll.	Not common: taken in rains and early hot weather.
Parnara mathias, Fab.	Extremely common during the rains at Duranta.
Badamia exclamationis, Fab.	A single specimen taken in the rains: Jaunpur.
Hasora chromus, Cr.	Taken on 16th July: Jaunpur.
Hesperia galba, Fab.	Several taken in July.

G. O. ALLEN, I.C.S.

DEHRA DUN, 19*th January* 1919.

No. XLII.—NOTES ON EMERGENCE FROM THE COCOON IN *LASIOCAMPIDÆ*.

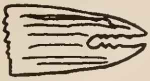
While at Basra in October 1918, I found some of the willow trees on the long island just above Gurmatali covered with caterpillars, recent cocoons and old cocoon shells. The larvæ and cocoons were of the *Lasiocampidæ* type and the former were of two kinds—one a chestnut brown, resembling the willow stalk in colour, and the other of a much lighter shade of yellow and white, like the under surface of the leaves.

An imago ♂ emerged from one of the smaller cocoons taken, and this closely resembled '*Taragama siva*.' This was sent to the B. N. H. Soc. for identification.

The following are a few notes on the larvæ:—

No. I.—20th October 1918—Cocoon being made, end slit open by larva and lightly saled inside. 22nd October 1918—Pupa formed 10th November. 1918—Moth emerged and this proved to be a ? *Taragama siva* ♀. She was placed in a mosquito net bag outside the window, but failed to attract any males. This specimen was also sent to the B. N. H. Soc. for identification.

No. II.—23rd October 1918—Darker type of larva started cocoon. 24th October—Cocoon nearly finished, but larva still depositing layers on the inside. At 1 P.M., larva bit its way out at one end and started to make deep clefts in the cocoon wall at two places opposite each other.



The opening thus made was tested several times as regards size with great deliberation, the larva extending half its body out of the cocoon to assure itself that the vent was large enough. The two clefts were then lightly sealed on the inside with a tangle of soft silk. 25th October—Cocoon apparently completed, but movements still continue inside.

No. III & IV.—31st October 1918—Two large larvæ of the lighter variety started making cocoons. The same stages were observed as noted above.

No. V.—10th November 1918—One large larvæ of the dark variety is making its cocoon.

I had to leave Basra soon after this and left the remaining larvæ and cocoons at the Central Laboratory.

In Maxwell-Lefroy's 'Indian Insect Life' there is a note on 'Emergence from the Cocoon' on page 481. He states that data are not available for many Indian insects and gives some of the commonest methods chiefly in order to direct the attention of the student to this neglected point. Some of the methods mentioned are :—

A—By the activity of the Pupa :
  i. The pupa releases itself by a large pair of mandibles (Micropteryx).
  ii. The pupal head has hard processes and the body is ciliated. (Anthrax).
  iii. The pupa escapes by wriggling out of the cocoon. (Psychidæ.)

B—By the activity of the imago :
  i. By the secretion of solvents to dissolve the cocoon, *e.g.*, by means of free Potass hydroxide in Puss moth cocoons.
  ii. By solvents supplemented by spines at the base of the costal edge (Saturnia, etc.).

C—By structural devices in the cocoon :
  i. One end is closed with thread loops only. (Uttacus).
  ii. The lips of one end close mechanically and can easily be opened from within (Eariæ)
  iii. A definite lid is provided to the cocoon. (Limacodidæ).

The author goes on to say that there are probably abundant devices as yet unknown, and the method employed by the larvæ, as described above, is as far as I know one of these.

It was a striking fact to observe how the larva, after all but completing the cocoon, always 'remembered' to destroy part of its laboriously built home by biting out two deep clefts at one end, and how the valve-like door thus made was patiently tested several times to make certain of its being of the right size and then carefully closed on the inside with a little soft silk which would not interfere with the emergence of the imago.

[The moth appears to be *Taragama siva* or a very closely allied race.—EDS.]

I would be very interested to know whether this device has been observed before in this or any other species. If the moths have been identified, I hope the editor will make a note of the specific name below.

F. P. CONNOR,
Lt.-Col., I.M.S.

The Field, Mesopot. Ex. Force.
December 1918.

No XLIII.—TENACITY OF LIFE OF *PARAPOLYBIA ORIENTALIS*, SANES.

While seated at my writing table in my bungalow at Dehra on 25th October something small fell on my head from the roof and something also fell buzzing on the table. I saw that the object on the table was a small insect of the wasp kind minus its abdomen. I looked up at the ceiling and as I expected saw a disappointed looking lizard. I then picked up the object off the floor and found it was the missing abdomen. With the aid of a pocket lens I found it to be still in a most animated state : if I touched it, out went its sting : whichever side I touched, the sting was automatically shot out on that side. After the lapse of a quarter of an hour or so it ceased to retaliate on being attacked.

Meanwhile the head and thorax complete with legs, wings and antennæ was walking about on the table. It frequently essayed flights but they did not get further than about a foot and the insect nearly always landed on its back from which position it recovered itself with some difficulty. It sat quite contentedly, wiped its antennæ in turn with its legs and touched its mouth with the ends of its antennæ. When brought in touch with its recently severed posterior it would not even recognize it!

G. O. ALLEN, I.C.S.

Dehra Dun,
29th January 1919.

No. XLIV.—PROTECTIVE HABIT OF THE LARVA OF *TRYPANOPHORA SEMIHYALINA*, KOLL.

About the 20th May 1918, I found in Mussoorie a strange looking larva feeding on the leaves of a common shrub, *Coriaria nepalensis*, Wall., locally known as Masuri, and having no idea what it was I kept it.

When the leaf on which it was seated was touched, beads of moisture at once appeared all over its body at the ends of the small tubercles and when the danger was overpast these beads would gradually recede inside again. This particular larva had plenty of practice in performing this feat as it received much attention from the children and became known as the "fountain caterpillar."

It ate from the top of a leaf and generally entirely finished a leaf at a time before going to another, the edge being eaten was straight and not concave. About a day before it pupated, I noticed it turning its head round and sucking up some of the beads : perhaps it had been recently called on to exude more than it could conveniently in that condition withdraw. It changed its skin about ten days or so before pupating, which occurred on 12th June. The imago emerged in Bahraich on 28th June.

G. O. ALLEN, I.C.S.

Dehra Dun,
29th January 1919.

No. XLV.—NOTE ON THE SUPPOSED EFFECTS OF THE BITE OF A PENTATOMID BUG (*HALYS DENTATUS*).

I am forwarding to you the enclosed letter from Mr. Levering of Secunderabad, Deccan, and an insect. Could you kindly tell me its name and whether it is poisonous ?

Two outstanding examples of this can be cited from this part of India, the Jerimundlam spider and the green whip snake, both being universally considered as deadly poisonous, yet both are harmless. The only snake I have ever had brought to me by an Indian and considered harmless was a young Russell's Viper !

I am sending you an insect which I found and killed in my bungalow, several days ago. I have found them about my rooms a number of times. I have never heard them called by any other name than the very unscientific one of "Mother Bugs."

We have had this experience with them. Several years ago we had a teacher named Nathaniel, who lived on the school compound near ours. He came over one evening bringing one of these insects, which he had killed, and which he said had stung him. His physical condition was somewhat peculiar ; his lower lip was swollen and hanging down. The lobes of his ears were somewhat swollen. About the upper portion of his body, on the front there were several "welts" rather large, and about two inches long. He was suffering a good deal. If I remember correctly his heart action was somewhat reduced. My wife gave him a stimulant, and he recovered in a short time.

Sometime after, one evening he and his wife came in with another of these insects. That time she had been stung. She was in rather a bad condition, and my wife, who, as you know, is a doctor, feared a collapse. She had on the upper portion of her body marks very similar to those on her husband. Under a stimulant she revived.

Can you tell what the insect is and if it is really dangerous ? Within four or five years there have been two deaths in our neighbourhood from the sting of some sort of insect. One was the son of a neighbour, a boy of about ten years. He was stung in the corner of the eye some time on a Saturday evening and died about noon on Monday. He was under the care of two well qualified doctors who both said that death was due to the sting. (Dr. Jivanji and Mr. Yelliah, an Assistant Surgeon, now dead, but then connected with the Civil Hospital.) (I did not talk with either of the physicians about the case, but was about the house and did talk with the parents.) The insect that stung this child was not seen, but was supposed to have been one of this species.

The other death was that of a smaller child and the friends said it was stung by one of these insects.

I should like to know whether the insect is really dangerous, or whether these cases that occurred on our compound, and seemed to be genuine stings of this insect, were probably due to some other cause. I have been misled so many times in India that I am a little sceptical.

Lallaguda, Deccan,
22*nd November* 1918.

E. H. HUNT.

[The Bug is a common species *Halys dentatus*, Fabr., belonging to the Pentatomidæ.

There is very little known about the habits and life histories of these bugs, but in an allied family it has been recorded by Lefroy that " some of these species have a painful bite, due to the injection of blind at the moment of puncture".—Eds.]

No. XLVI.—A FEW ADDITIONS TO THE LIST OF MUSSOORIE PLANTS BY JAMES MARTEN IN VOL. XIX, p. 475.

I collected a few plants while on a short visit to Mussoorie in May and early June 1918 and find the following not in the above mentioned list. My specimens where I was not absolutely certain of them were very kindly identified for me at the Royal Botanic Garden, Sibpur. In several cases I see I have found an early flowering species while others of the same genus in Marten's list flower in the rains and autumn.

Ranunculaceæ.	
Ranunculus lætus, Wall.	Common in damp meadows at the Park and Brewery; at their best during the first half of May.
Barberidaceæ.	
Berberis lycium, Royle.	Very common: flowers in April and early May.
Cruciferæ.	
Cardamine impatiens, L.	Very common: ceases flowering by the middle of May, but the bursting of the seedpods is the most interesting thing about them.
Polygalaceæ.	
Polygala abyssinica, Tres.	In flower in May: fairly common.
Caryophyllaceae.	
Cerastium glomeratum, Thuill.	(=C. vulgatum, L. var. glomerata, Thuill of F. B. I.) A common flower in May.
Leguminosæ.	
Vicia tenera, Grah.	Flowering in May.
Trifolium pattense, L.	Plenty of this familiar flower in the Company Gardens in May.
Indigofera gerardiana, Wall.	Commences to flower towards mid May.
Rosaceæ.	
Spiræa bella, Sims.	Fairly common.
Crassulaceæ.	
Sedum adenotrichum, Wallich var. genuinum, R. Hamet.	Common in Mayon stony ground.
Onagraceæ.	
Oenothera rosea, Sims.	This common weed is no doubt referred to as Oenothera sp.
Caprifoliaceæ.	
Leycesteria formosa, Wall	Fairly common on the way to the park.
Valerianaceæ.	
Valeriana wallichi, DC.	Very common in April: over by middle of May.
Dipsaceæ.	
Morina persica, L.	This thistlelike plant is found flowering on grassy plots in May.
Compositæ.	
Ainsliaea pteropoda, DC.	The spikes are familiar roadside objects in early May.

Launea secunda, Clark.	Fairly common on dry banks in May.
Senecio nudicaulis, Ham.	Common in similar situations.
Taraxacum officianale, Wigg.	Common: closely resembles the British Dandelion.
Erigeron alpinus, L.	A very common daisy: leaves narrowly lanceolate.
,, canadense, DC.	Not common: flowering in early June: apparently is not found at Simla.
Primulaceæ.	
Primula floribunda, Wall.	Found a number of these miniature primroses in flower on 2-3-16: saw one plant in flower on 10-5-18.
Androsace rotundifolia, Hardw.	Fairly numerous in early June.
Asclepiadaceæ.	
Ceropegia wallichii, Wight.	Rare: found a single example of this extraordinary looking flower on Fox's Hill on 20th May: rare in Simla.
Scrophulariaceæ.	
Mazus surculosus, Don.	Not often seen: found in the Park and another spot in May.
Verbenaceæ.	
Caryopteris wallichiana, Schauer.	Fairly common in early June.
,, grata, Bth.	Not uncommon: apparently not found in Simla.
Labiatæ.	
Calamintha umbrosa, Bth.	Common.
Stachys sericea, Wall.	Found in flower in the Park in middle of May.
Scutellaria scandens, Don.	(= S. angulosa, Bth.) Very common on banks in May.
Euphorbiaceæ.	
Euphorbia pilosa, Linn.	Numerous in shady spots.
Lilaceæ.	
Smilax aspera, Linn.	This prickly climber is often seen, but does not flower till the autumn.

G. O. ALLEN, I.C.S.

DEHRA DUN, *28th January* 1919.

No. XLVII.—ON THE IDENTITY OF *BLASTOSPORA BUTLERI*, SYD.

Sydow and Butler in their "Fungi Indiae orientalis," Part IV, describe a rust fungus on *Jasminum malabaricum* from specimens collected by the writer at Matheran in the Bombay Presidency. In giving the fungus the name *Blastospora* the authors express a doubt whether it really belongs to that genus, as they had not observed the germination of the teleutospores. The tops of some of the teleutospores were observed by them to be prolonged into a sort of papilla and these were suspected by them to be showing the initial stages of germination characteristic of *Blastospora* teleutospores, which have no distinct germ pores and which germinate by the bulging out of the top wall itself into a germ-tube (see Fig. 1).

Fig. 1

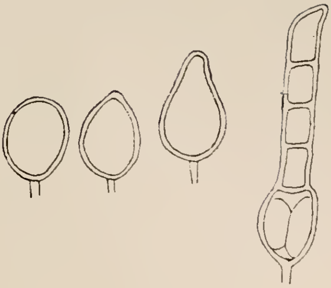


Fig 2

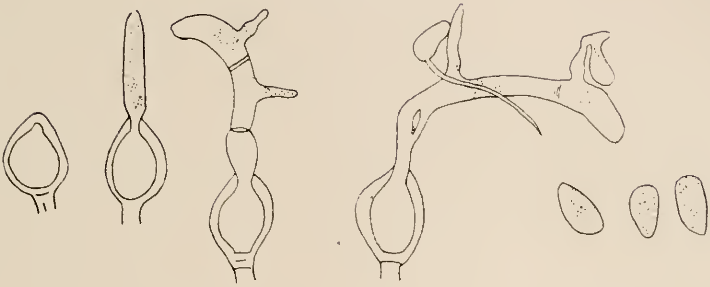


Fig. 3

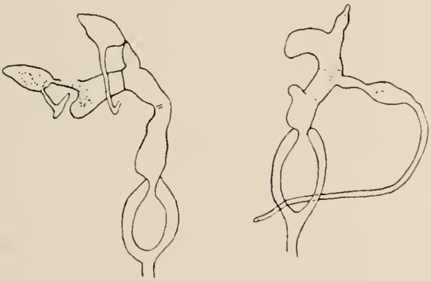


Fig. 4

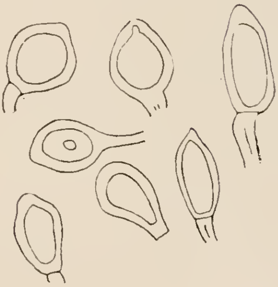
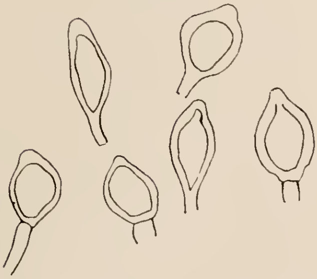
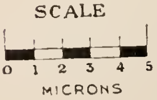


Fig. 5





ON THE IDENTITY OF *BLASTOSPORA BUTLERI*, Syd.

(Fig. 1) Germination of teleutospore of *Blastospora* (after Von P. Dietel).
(Fig. 2) Germination of teleutospores of *Uromyces* on *Jasminum malabaricum*.
(Fig. 3) Germination of teleutospores of *Uromyces Hobsoni* on *Jasminum grandiflorum*.
(Fig. 4) A group of teleutospores of *Uromyces* on *Jasminum malabaricum* (to show variation in size and shape.)
(Fig. 5) A group of teleutospores of *Uromyces Hobsoni*.

In the months of December 1912 and January 1913 the writer succeeded in germinating the teleutospores of the supposed *Blastospora* in distilled water and it became evident that the above identification was incorrect and that the fungus in question is a true *Uromyces*. A true germ-tube was seen to come out through a germ pore (see Fig 2).

It may be mentioned in passing that this *Uromyces* on *Jasminum malabaricum* bears a very close resemblance to *Uromyces Hobsoni*. Vize (*U. Cunninghamianus*, Barc.) on *Jasminum grandiflorum*. The teleuto and æcidial stages agree closely on both hosts, in microscopic characters (see Figs. 2, 3, 4, and 5) as well as in the effects produced on the host. There is one striking difference, however. Whereas *U. Hobsoni* has no uredo stage, as Barclay has proved, the fungus on *J. malabaricum* shows a uredo stage in association with the teleuto. The writer made several inoculations and cross-inoculations with the different spore forms found on either host, but with negative results. It remains doubtful, therefore, if the fungi on the two hosts are identical and if the uredo stage found on *J. malabaricum* actually belongs to the *Uromyces* found on it. The writer had hoped to be able to work out the complete life-history of this interesting fungus and, to settle its relationship with *U. Hobsoni*, but for some reasons the investigation has remained in abeyance for the last few years. In the meantime it is thought fit to put on record the observation of the germination of the teleutospores which establishes beyond doubt that the fungus is a *Uromyces* and not a *Blastospora*.

REFERENCES.

(1) Sydow et Butler: "Fungi Indiæ orientalis," Part IV. Mycol. Vol. X., No. 3, 1912.

(2) Von P. Dietel: "Uredineen aus Japan II" Annal. Mycol. Vol. VI, No. 3, 1908.

(3) Barclay: "On the life-history of a remarkable uredine on Jasminum grandiflorum" Trans. Linn.. Soc. of London, Vol. III, Part II, 1891.

S. L. AJREKAR, B.A.

Agricultural College, Poona,
11*th February* 1919.

BIOLOGICAL LIBRARY

PROCEEDINGS

OF THE MEETING HELD ON 28TH NOVEMBER 1918.

A meeting of members of the Bombay Natural History Society, and their friends, took place on Thursday, the 28th November 1918, Mr. John Wallace presiding. The election of the following 22 members since the last meeting was announced:—

Lt. A. G. McArthur, I.A.R.O., Dadar, Bombay; Mr. T. E. Love, Quilon; Mr. R. Senior-White, F.E.S., Ceylon; The Curator, Central Museum, Nagpur; the Principal, Belgachia Medical College, Calcutta; Major C. H. Browne, Madras; Assistant Surgeon H. Vincent, Poona; Mr. W. Y. Austin, Kaira; Mr. V. K. Namjoshi, Cambay; the Judicial Secretary to Government, U. P., Allahabad; Capt. R. Y. Anderson-Morshead, Trimulgherry; De Directeur, van Het Algemeen Proefstation, Medan, Sumatra; Mrs. H. A. Marshall, Travancore; Mr. A. L. Sheather, Muktesar, U. P.; Mr. A. A. Graham, Mussoorie; Lt.-Col. J. H. V. Barr, Bandar Abbas; Major R. C. Burke, Simla; Miss R. H. Western, Palampur, Punjab; Lt.-Col. the Nawab Sir Afsurul-Mulk Bahadur, A.D.C., K.C.I.E., M.V.O., Hyderabad, Deccan; Mr. H. C. Barnes, I.C.S., Naga Hills; Mr. Jamshed Vesugar, Rawalpindi; Lt.-Col. G. R. Row, I.A., Calcutta; and 2-Lt. J. M. Muirhead, Anandi West.

The following contributions to the Museum were received since the last meeting:—

Contribution.	Locality.	Donor.
1 Fresh water shrimp	Dinapur, Bihar	Capt. A. S. Brooke.
1 Bear Skull	Kohima, Assam	Mr. J. H. Hutton.
5 Eggs of white tailed plover (*C. gregaria.*)	Museigil, Mesopotamia.	Lt. T. R. Livesey.
1 Egg of Common Coot (*Fulica atra.*)		
1 Rat Snake *Z. mucosus*	Bassein, Bombay	Mr. A. P. Kinloch.
1 Buff striped Keelback, *Tropidonotus stolatus.*		
1 Eryx		
1 Russels Earth Snake (*Eryx conicus.*)		
1 Eel Fish		
1 *Dryophis perrotteti*	Nilambur, S.I.	Mr. A. M. Kinloch.
1 *C. calcaratus*		
1 Egg of Malabar Trogon (*Tragon fasciatus.*)		
5 Marmot skins	Tibet	Mr. C. H. Dracott.
1 Young Star Turtle (*T. elegans*) (alive.)	Colombo	Mr. Robinson.
1 Lizard (*Agaura* sp)	Mesopotamia	Capt. E. H. Martin.
9 Birds, 1 Bat, 1 Shrew, Javelin Sandboa (*E. jaculus.*)	Do.	Lt. R. E. Cheesman.
35 Birds' Eggs, 4 Snakes, 4 Bats, 1 Lizard, 7 Scorpions, 1 Centipede, 2 Spiders	Rangoon	Dr. H. H. Marshall.

Contribution.	Locality.	Donor.
1 Flying lizard *Draco dussumeri.*	Kotagiri, Nilgiri Hills.	Capt. P. H. Gosse, R.A.M.C.
3 Grizzled Indian Squirrel	Madura, S. I.	Mr. R. F. Stoney.
5 Bats	Karachi	Capt. C.B. Ticehurst, R.A.M.C.
1 Striped Squirrel (*F. penanti Ratufa macraura dandolena.*)		
1 Mouse		
1 Viriditar-blue Flycatcher	Kurduvadi, Deccan.	Mr. D. F. Woods.
1 *Zamenis diadema*	Mesopotamia	Lt.-Col. H. H. Smith.
Few Butterflies	Do.	Lt.-Col. H. P. Peile, I.M.S.
1 *Echis colloratus*, 2 *Z. ventrimaculatus*, 1 *Trop. tessollatus*		
1 Cormorant (*P. carbo*)	Kohat	Dy. Commissioner.
1 Pseudo Scorpion	Muscat	Capt. C. W. Sanders.
52 Birds	Coorg	Capt. N. B. Kinnear.
Insects		
Snakes, etc.		
2 Snakes	Tura, Assam	Mrs. F. E. Jackson.
1 *Contia* sp.	Linga. P. Gulf	Mons. H. J. Bourgeoise.
1 Longicorn Beetle (*Noocerambyx grandis.*)	Tavoy. Burma	Mr. C. Hopwood.
1 *Tylototriton verrucosus*	Taungyi. Burma	Mr. W. O. Hanuyngton.
1 *Zamenis rhodorachis*	Muscat	Major K. G. Gharpurey, I.M.S.
2 *Maubia* sp.		
2 Gecko		
2 Scorpions		
2 Wigeon (*Marecea penelope*)	Jhansi	Major V. Coats.
1 Great Crested Grebe (*P. cristatus.*)	Mesopotamia	General Brooking.

With reference to the Society's Journal, the Secretary apologised for Journal No. 1, Vol. XXVI, being so late but there had been many delays in obtaining some of the proofs from England. He hoped that it would be issued to members in December and the index number (No. 5, Vol. XXV) would be ready soon after.

Prof. Hallberg then read a paper on a Botanical tour in Kashmir, which was illustrated by a large number of beautiful photographs, both of flowers and scenery in Kashmir.

OF THE MEETING HELD ON 27TH FEBRUARY 1919.

A meeting of members and their friends took place on Thursday, 27th February, the Hon. Mr. G. Carmichael, C.S.I., presiding.

The election of the following 41 members since the last meeting was announced :—Mr. K. K. Chakravarty, Dacca ; Mr. W. de Zwart, Medan, Sumatra : Major E. A. Arthur, Mesopotamia ; the Principal, Gujerat College, Ahmedabad : Capt. C. Benson, A.D.C., Bombay ; Capt. E. A. Goldie, M.C., I.M.S., Mesopotamia : Lt.-Col. R. W. C. Keays, Mesopotamia : His

Excellency Sir George Lloyd, D.S.O., G.C.I.E., Bombay; Capt. C. E. M. Judge, Delhi; Lt.-Col. W. R. Lawrenson, Madras; Mr. F. V. Clark. Htawgaw, Burma; Mr. C. J. Brown, Lucknow; Mr. A. Locket, Assam; Mr. C. McCann, Bombay; Mr. Ganda Singh Cheema, M. Sc.; Lahore; Mr. M. Mitra, M.Sc., Agra; Mr. D. M. Short, Villupuram; Lt. F. W. A. Phillips, Ceylon; Mr. R. Finney, Golaghat, Assam; Mr. J. H. Hutton, Calcutta; Mr. D. G. Harris, Ghazipur, U. P.; Mr. Govind P. Damania, Versova; Mr H. B. Copley, Kotah, Rajputana; Lt. A. Ashton, Agra; H. H. the Jam Saheb of Nawanagar, Jamnagar, Kathiawar; Mr. H. T. McLeod, A.M.I.C.E., F.R.M.S., Guntakal; Mr. James Beckett, Penukonda, Anantapur Dist.; Mrs. H. M. Rait Kerr, Kirkee; Mr. G. R. Atkinson, Dharwar; Lt. G. A. D. Simpson, Fort Lockhart, N. W. F. P.; Mr. H. A. W. Brent, Bombay; Miss A. M. Webbe, Barout, Meerut Dist.; Major S. St. M. Carter, D.S.O., R.A.M.C., Simla; Mr. R. R. Mole, C.M.Z.S., Madras; Lt.-Col. H. A. Newell, I.A., F.R.G.S., Madras: Major M. D. Ritchie, I.M.S., Calcutta; Mr. E. Dainttith, I.A.R., Ahmednagar; Mr. J. P. Norris, Philadelphia, U. S. A.; Mr. B. P. Tailyour, Srivilliputur, Ramnad Dist.; Capt. H. R. Lanktree, Rangoon; and Mr. B. V. Vakil, B.Sc., Bombay.

The following gentlemen were elected as Office Bearers for the present year.—President: H. E. the Right Hon. Sir George Lloyd, D.S.O., G.C.I.E. Vice-Presidents: Mr. J. D. Inverarity, B.A., LL.B., the Hon. Mr. Justice N. C. Macleod, and H. H. the Maharao Saheb of Cutch, G.C.S.I., G.C.I.E.

Managing Committee:—Mr. T. Bainbrigge Fletcher, F.E.S., Mr. T. R. Bell, C.I.E., I.F.S., Rev. E. Blatter, S.J., Mr. E. Comber, F.Z.S., Col. G. H. Evans, C.I.E., F.L.S., Major M. L. Ferrar, I.A., C.B.E., Major F. C. Fraser, I.M.S., Mr. F. Hannyngton, I.C.S., Lt.-Col. J. E. B. Hotson, I.A.R.O., C.B.E., (I.C.S.), Mr. C. M. Inglis, Prof. V. N. Hate, Capt. N. B. Kinnear, M.B.O.U., Lt.-Col. W. Glen Liston, C.I.E., I.M.S., Mr. F. M. Mackwood, Mr. H. P. Macnaghten, Mr. P. J. Mead, C.I.E., I.C.S., Mr. R. A. Spence. Lt.-Col. F. Wall, I.M.S., C.M.G., Lt.-Col. H. J. Walton, I.M.S., C.M.Z.S., Mr. John Wallace.

Mr. L. H. Savile, Honorary Treasurer, and Mr. W. S. Millard, Honorary Secretary.

The following contributions to the Museum were received since the last meeting:—

Contribution.	Locality.	Donor.
Skulls of 2 Impala (*Aepycoros melampus*). 2 Roan Antelopes (*H. equinus*) 3 Coke's Hartebeste (*Bubalis cockei*). 1 Grant's Gazelle (*G. granti*) 2 Oryx (*O. besia*) .. .. 2 Topi (*D. korrigum*) .. 1 Waterbuck (*Cobus defarsa*) 8 Thomson's Gazelles (*G. thomsoni*).	British German East Africa.	Lt.-Col. W. R. Lawrenson.

Contribution.	Locality.	Donor.
1 Hare (*Lepus* sp.), 1 Jackal (*C. aureus*), 1 Pigmy, 1 Musk Shrew, 1 Bat, 1 Fox (*Vulpes* sp.), 1 Lizard (*agava*).	Basra	Lt.-Col. F. P. Connor, I.M.S.
2 Lizards, 5 Snakes	Nasik	Mr. D'Cunha.
1 Spur Fowl (*G. spadicea*)	Thana	Major M. L. Ferrar.
11 Birds' nests	Darjeeling	Mr. E. A. D'Abreu.
1 Curlew (*H. acquata*)	Kolaba, Bombay	Mr. J. A. D. McBain.
1 Avocett (*R. avocetta*)		
2 Coots (*F. atra*)		
1 Dotterel (*E. morinellus*)	Mesopotamia	General Brooking.
1 Spot-billed Duck (*A. pæcilo ryncha*).	Srinagar	Lt.-Col. D. G. Oliver.
1 Silybura sp.	Nelliampatty Hills	Mr. A. P. Kinloch.
1 Malabar Civet Cat. (*V. civettina*)	Trivandrum	Zoological Gardens, Trivandrum.
1 Albino Snipe (*G. coelestes*)	Near Bombay	Mr. H. A. W. Brent.
2 Hares (*Lepus* sp.)	Jhang, Punjab	Capt. C. B. Ticehurst, R.A.M.C.
2 Hedgehogs (*E. blanfordi*)		
1 Fox (*V. bengalensis*)		
1 Yellow Bat (*S. khuli*)		
1 Thrush (*Z. monticola*)	Kumaon	Mr. S. J. Martin.
1 Blackbuck skull (malformed)	Ahmedabad	Rev. D. Archer.
18 Birds	Nasik	Capt. N. B Kinnear.
1 Shikra (*A. badius*)	Bombay	Mr. W. S. Millard.
1 Bandicoot (*B. malabarica*)		
1 Pintail (*D. acuta*)	Mesopotamia	Lt. A. St. J. Macdonald.
1 Wigeon (*M. penelope*)		
1 Tufted Duck (*F. fuligula*)		
1 Mallard		
1 Gadwall (*C. streperus*)		
1 Sheldrake (*T. cornuta*)		
2 Black partridges (*F. francolinus*).		
1 Hooded Crow (*C. capellanas*)		
2 Sheldrakes (*T. cornuta*)	Jamnagar	H. H. The Jam Saheb.
1 Imperial Eagle (*A. heliaca*)	Goona, C. I.	Mr. T. B. Hawkins.
1 Courser (*C. coromandelicus*)		
1 Golden Cat (*F. temmincki*)	Htawgaw, Burma.	Mr. F. V. Clerk.

Minor contributions from:—Mr. F. J. Mitchell, Lt.-Col. H. D. Peile, Mr. D. G. Cameron, and Major R. D. O. Hill.

CONTRIBUTIONS.

Capt. N. B. Kinnear, the Keeper of the Museum, made the following remarks on the specimen received since the last meeting:—

The Indian contributions are 2 hares, a hedgehog and a fox from Capt. C. B. Ticehurst, Jhang, Punjab. A golden cat from Htawgaw, Burma, sent in by Mr. F. V. Clark, and 18 birds' skins collected by Capt. Kinnear at

Nasik and 5 birds by Mr. J. A. D. McBain in the Kolaba District. A griffon vulture was presented by Mr. H. Whistler, from Jhang. 2 sheldrakes were obtained for us at Jamnagar by H. H. the Jam Saheb, and a spot-billed duck taken at Srinagar, Kashmir, was sent in by Col. D. G. Oliver. Mr. T. B. Hawkins presented an Imperial eagle and a courser from Goona, C. I., Major M. L. Ferrar, a spurfowl from the Thana District and Mr. H. A. W. Brent, an albino snipe from the vicinity of Bombay. A curiously malformed black buck head was received from Revd. D. G. Acland. The Society is indebted to the Trivandrum Zoo for the skin of a Malabar civet cat and to the Colombo Museum for a few mammal skins presented by them.

The following papers were read :—(1) "Expected Plague of Field Rats in 1920" by L. J. Sedgwick, I.C.S. (2) "Wild Forms of Bombay Island and Salsette" by Prof. J. F. R. D'Almeida. The papers will be published in full in the Society's Journal. The meeting ended with a vote of thanks to the various contributors.

ACCOUNTS FOR 1918.

Mr. L. H. Savile, the Honorary Treasurer, presented the accounts for 1918. Referring to the membership he stated that the number of members at the end of the year under review was 1,775 as compared with 1,738 in 1917 showing a fairly satisfactory increase considering that the war was still in progress, 142 new members joined the Society during 1918 compared with 99 in 1917. He expressed a hope that now that the war was over, 1919 would show a much larger increase in membership as well as in the activities of the Society.

Referring to the accounts the Honorary Treasurer stated that the opening balance was Rs. 2,945 and the closing balance (omitting Rs. 12,000 on fixed deposit) was Rs. 3,384. The receipts show an increase of Rs. 3,097 due largely to increase in membership, while the expenditure (which included an increase in the salary of the staff and a victory bonus of one month's pay) was—allowing for one or two special items in 1917—about the same as last year.

The Mammal Fund accounts were also presented. As the original collectors were still on active service little work was done during the year. The opening balance was Rs. 8,962 and the closing balance Rs. 8,684.

As the war is now over the Committee have decided if possible to continue the Survey during the current year, and have written to the original collectors with a view to their continuing their work ; should this, as it is hoped to be found possible, a large increase in the funds will be required and it is hoped, therefore, that all members of the Society who are interested in this work will contribute towards the continuing of the survey to a satisfactory completion.

OF THE MEETING HELD ON 3RD APRIL 1919.

A meeting of members and their friends took place on Thursday, the 3rd April, 1919, Major F. C. Fraser, I.M.S., presiding.

The election of the following 12 members since the last meeting was announced :—The Principal, Central College, Bangalore ; Captain F. W. Williamson (I.C.S.), Bombay ; Lieut. R. Hailstone, Bombay ; Lieut. J. A. H. Maund, Bombay ; Captain C. de C. Martin, I.M.S., Bombay ; Major Allan

Brooks, D.S.O., Canada; Mr. F. L. Usher, Bangalore; the Head Master, Abu High School, Mount Abu; Mr. R. H. Corbett, Papun, Burma; Captain E. de V. Moss, Madras; Mr. W. A. Hickie, Budge Budge, Bengal; and Brigadier-General E. Dickson, Europe.

The following contributions to the Museum were received since the last meeting:—

Contribution.	Locality.	Donor.
1 Nukhta (*Sarcidornis melanotus*)..	Karimpore, Assam	Mr. J. Curror.
2 Black Partridges (*F. francolinus*)	Jhang, Punjab ..	Mr. H. Whistler, F.Z.S., M.B.O.U.
1 Monitor (*V. bengalensis*) ..	Kotah	Mr. H. Copley.
1 Buff-striped Keelback (*T. stolatus.*)		
1 Common Wolf Snake (*L. aulicus*)		
1 Star Tortoise (*T. elegans*) alive.	Ahmedabad ..	Mrs. McCormack.
2 Nilgiri Langurs (*Pithecus johnii*)	Nelliampatty Hills.	Mr. A. M. Kinloch.
5 Birds	Karachi	Capt. C.B. Ticehurst.
1 Phoorsa (*E. carinata*) ..	Bushire	Col. C. Bowle-Evans, I.M.S.
1 Spider		
1 Red Sheep	Persia	Major E. J. Arthur.

Minor contributions:—Mr. G.O. Allen, Mr. D.G. Cameron and Capt. Dodds.

CONTRIBUTIONS.

In the course of the paper, the possibility of finding a substitute for cotton was discussed in somewhat technical detail. The relative merits of silk cotton and ordinary cotton for textile purposes were dwelt upon and the conclusion arrived at that so far the experiments to find a suitable substitute for cotton have not been very successful. We must not forget, in addition, that vegetable silk especially Calotropis silk, was comparatively expensive, because there is a great demand for it as stuffing material in the manufacture of safety belts. On the other hand, there were vast stretches in India, especially in the drier parts, Deccan, Gujarat, Rajputana, Punjab, where nothing of economic value was growing, but where the soil was admirably adapted for the cultivation of Calotropis. Calotropis silk has got one great advantage over other vegetable silks: its cultivation does not require any special care, and the silk is easily separated from the seeds. Calotropis silk would be cheaper, comparatively, than any other vegetable silk, and even if it should never develop into a substitute for cotton, it would always find a good market as stuffing materials.

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THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U.

Part XXVII.

With a Coloured Plate.

(*Continued from page* 337 *of Volume XXVI.*)

Genus—*TRAGOPAN.*

Having accepted Beebe's classification of the Pheasants and Partridges founded on the moulting sequence of the tail-feathers, this grand genus heads the *Perdicinæ*, or true Partridges.

Like the great majority of Pheasants, however, the two sexes are different in colour. The males are magnificent birds, generally with a great deal of crimson in their plumage, replaced in Cabot's Tragopan by buff. Two small fleshy horns of bright colour lie hidden in the feathers of the crown, but during the breeding season are erectile and swollen. An apron-like lappet hangs from the chin, folded into mere wrinkled skin normally, but extending a couple of inches or more during display.

The females are brown or grey-brown birds, mottled with back, rufous and a little white, and are very game in their general appearance. They have no horns or lappet. In shape the birds of this genus are much like huge partridges; the tail is a little longer than the wing or about equal to it, and is carried in the same manner as that of the Common Partridge. The legs are very powerful, and are armed with a short blunt spur; the wings are rounded, the first primary the shortest and the fourth and fifth sub-equal and longest*. The tail is strongly graduated, the central feathers being about two-fifths longer than the outermost. The bill is rather small, and the feathers of the forehead and lores run almost up to the outer edge of the nostril. In most species the sides of the face are bare, but in the Satyr or Crimson Tragopan they are well feathered. The throat and chin are very sparsely feathered in the adults, but well covered in the young. At present five species are known, all of which, with the exception of the Eastern Chinese bird, *Tragopan caboti*, come within the areas included in these articles.

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* The bastard wing is enormously developed and of a different colour to the rest of the wing in most of the species.

KEY TO THE SPECIES AND SUB-SPECIES.

- *A.* Heads black with crimson markings (Males).
  - *a.* Below crimson, with black-edged white spots ... ... *satyra.*
  - *b.* Below black with white spots ... *melanocephalus.*
  - *c.* Whole breast crimson-red, abdomen smoky-grey or sepia-grey ... *blythi blythi.*
  - *d.* Crimson, confined to extreme upper breast as a narrow gorget ... *b. molesworthi.*
  - *e.* Below crimson, feathers centred with pearl-grey ... ... *temmincki.*
  - *f.* Below buff ... ... *caboti.*
- *B.* Head brown, mottled like upper plumage (Females).
  - *g.* Upper plumage streaked with white.
    - a^2. Centre of abdomen grey ... *melanocephalus.*
    - b^2. Centre of abdomen white or buffy-white ... ... *caboti.*
  - *h.* Upper plumage streaked with fawn or buff ... ...
    - c^2. Shoulder of wing tinged with crimson ... ...
      - a^2. General tint darker owing to black markings predominating ... ... *blythi blythi.*
      - b^2. General tint paler and more buff. Black markings fewer ... ... *satyra.*
    - d^1. No crimson tinge on shoulder of wing ... ... *temmincki.*

TRAGOPAN SATYRA.

The Crimson-Horned Pheasant.

Horned Indian Pheasant.—Edward's Nat. His. B. iii. pl. 116 (1750) (Bengal).

Phasianus bengalensis cornutus.—Brisson Orn. vi. app. p. 14 (1760) (Bengal).

Meleagris satyra.—Linn. Sys. Nat. i., p. 269 (1766) (Bengal) ; Latham Ind. Orn. ii., p. 619 (1790) ; Griff. ed. Cuv. iii. pl. (1829).

Phasianus cornutus.—Mull. Suppl. Linn. Syst. Nat. p. 125 (1776) ; Stephin Shaw's Gen. Zool. xi., p. 239 (1819).

Penelope satyra.—Gmelin. Sys. Nat. 1 pt. ii., p. 733 (1788) ; Bonnat. Tab. Encl. Meth. i., p. 170, pl. 84 (1791).

Phasianus satyrus.—Temm. Pig. et. Gal. ii., p. 349 (1813) ; ibid. iii. p. 672 (1815) ; Vieillot Nov. Dic. Nat xi., 1817, p. 39 ; id. Gal. Ois. ii., 1825, p. 23, pl. 206.

Horned Pheasant.—Lath. Gen. Hist. viii. p. 208 (1823).

Tragopan satyrus.—Cuv. Reg. Anim. i. p. 479 (1829) ; Gray in Griff. ed. Cuv. iii. p. 31 (1829) ; Gould Cen. Him. Birds, pl. 62 (1832) ; Jerd. Nat. Lib. Orn. iv. p. 222, pl. xxiv (1834) ; Temm. Pl. Col. v. pls. 13, 14 (1834) ; Ogilvie-Grant Cat. B. M. xxii. p. 271 (1893) ; id. Hand-L. Game-B. i., p. 220 (1895) ; Blanford, Fauna B. I. iv. p. 99 (1898) ; Oates, Game-B. Ind. 1 p. 241 (1898) ; Oates, Cat. Eggs B. M. i. p. 50 (1901) ; Ghigi Rend. Acc. Bologna (5) x. pp. 403-4 (1903) ; Smith Avi. Mag. (3) i., p. 225 (1910) ; Walton, Ibis, 1906, p. 247 ; Seth-Smith, Avi. Mag. (3) ii. p. 212 (1911) ; Finn., Game-B. India, p. 28 (1911) ; Beebe, Zoologicæ 1 No. 15, p. 269 (1914) ; id. Pheasants, i. p. 49 (1918).

Satyra satyra.—Less. Dict. Sci. Nat. lix. p. 196 (1829) ; id. Traite d'Orn. p. 493 (1831).

? Phasianus nepaulensis.—Gray, in Griff. ed. Cuv. iii., p. 29 (1829).

Phasianus melanocephalus.—Gray, Ill. Ind. Zool. i. p. 47 (1830-32).

Satyra pennanti.—Gray Ill. Ind. Zool. i. pl. 49 (1830-32).

Satyra lathami.—Gray, Ill. Ind. Zool. i. pl. 51 (1830-32).

Satyrus cornutus.—Schinz. Nat. Abild. Vog. p. 252, pl. 98 (1833).

Satyra nepaulensis.—Gray, Ill. Ind. Zool. pl. 40 (1834).

Tragopan melanocephalus.—Jard. Nat. Lib. Orn. iv., p. 226, pl. xxvii (1834).

Ceriornis macrolophus.—Swain. Class. B. ii., p. 341 (1837).

Satyra (tragopan) alpnis.—Thien., Fortpflanz. ges. Vog. p. 52, tab. xii. fig. 4 (1845-54).

Ceriornis satyra.—Gray, Cat. Hodg. Mam. & B. ed. i., p. 125 (1846) ; Blyth, Cat. Mus. As. Soc. p. 240 (1849) ; Sclater and Wolf, Zool. Sketches, 2 pl. 39 (1831) ; Jerdon, B. of In. iii. p. 516 (1863) ; Sclater, List, Phas. p. 10 (1863) ; Irby, Ibis. 1868, p. 234 ; Beavan. Ibis 1868, p. 379 ; Gould, B. of Asia, vii., pl. 49 (1868) ; Bulger, Ibis 1869, p. 169 ; Sclater, P.Z.S. 1870, p. 164 ; Elliot, Mon. Phas. i pl. 22 (1872) ; Murie, P.Z.S. 1872, p. 730. pls. lx, lxi ; Hume, Nests and Eggs, p. 521 (1873) ; Marshall, B. Nest In. p. 59 (1877) ; Hume and Marsh. Game-B. In. i p. 137 (1878) ; Scully, Str. Feath. viii., p. 343 (1879) ; Sclater P.Z.S. 1879, p. 117, pl. viii. fig. 4 ; Oates ed. Hume's Nests and Eggs, iii. p. 409(1890).

VERNACULAR NAMES.—Lungi (*H. Garhwal and Kumaon*) ; Monal (*H. Nepal*) ; Omo. Bap. (*Bhutia*) ; Tar-rhyak (*Lepcha*) ; Cham-dung (*Tibetan*).

Description—Adult Male.—Head, crest, and a broad ring surrounding the semi-naked gular patch, black. A streak on either side of the crest, sides of the neck, hind neck, upper back, and the whole of the lower plumage orange-crimson ; the upper back and lower plumage from the breast to the vent with white black-edged ocelli. On the breast and upper back the spots of white are small and completely surrounded with a comparatively broad edging of black ; towards the vent the spots get larger and larger, the white less pure and more grey, and the black proportionately less in extent until the spots on the posterior flanks and abdomen become large gray blotches with black at the bases only. The under tail-coverts are crimson with white ocelli surrounded by brown with black terminal fringes.

Lower back, scapulars rump and shorter tail-coverts olive-brown with white, black-edged ocelli and black and rufous buff vermiculations; longer tail-coverts amber-brown with sub-terminal broad black edges. The scapulars are profusely marked with crimson and occasional similar marks appear on the back and outer edge of rump and upper tail-coverts.

Shoulder of wing crimson; coverts like the scapulars, the greater coverts showing broad bases of mottled buff and black. Inner secondaries like the greater coverts, but with no crimson; outer secondaries and primaries deep brown, with numerous broken mottlings of buff. Bastard wing chestnut, mottled at the tip on inner webs with dark-brown.

Colours of Soft Parts.—Bill, brownish black, black at the base; irides, brown, or hazel-brown; legs, dull fleshy, deepening in colour and suffused with crimson during the breeding season; claws, pale horny-brown; spur, pale grey-brown, almost white at the tip. Horns, dull Prussian blue, becoming much brighter during the breeding season; lappet, Prussian blue, the same colour as the whole of the gular and orbital region, but when extended the edges show a bright sage-green, with four, rarely five, triangular patches of brilliant deep scarlet.

Measurements.—Length, 671-722 mm. (Beebe). Wings, 245 to 285 mm. Average of 30 birds, 268· 5 mm. The bastard wing measures up to 137 mm. Tail, 232 to 300 mm., average, 269·5 mm. Bills from front to tip in a straight line, 14-16 mm.; tarsus, 85 to 90 mm., with the short spur measuring from 10 to 15 mm.

Weight, 3 lbs. 8 ozs. to 4-lbs. 10 ozs. (Hume).

Two fine males shot by my collectors during the breeding season were said to weigh a little under 2½ seers=5 lbs. Both these birds were said to be very fat.

Adult Female.—Whole plumage above rufous-buff or rufous-ochre, vermiculated, barred and blotched with black and with narrow pale ochre central streaks; tail, rich rufous-brown with broken buff and black bars, the black grading into the general rufous-brown; the black on the inner webs of the outer tail feathers developing into broad well-defined bars.

Below, the chin and throat is generally pale, sometimes almost albescent,—the breast is like the back, but paler and less richly coloured; on the abdomen and vent the general tint becomes still paler, and the central streaks develop into large white spots.

Wings like the back, the inner webs of the quills browner, and less richly coloured; under wing-coverts, axillaries and flanks like the back.

The variation in the plumage of the female is far greater than in the adult male, and birds from the same locality differ to such an extent that it is hard to believe they are the same species. In some the rich rufescent tone is almost entirely absent, being replaced with grey, which gives the dominant tinge to the whole appearance. In others the ochre centres are larger and brighter and ochre to a great extent replaces the rufous in the mottlings as well. In a few birds the centre of the crown has the features marked with deep bright chestnut, and the same colour appears here and there on the wing-coverts, scapulars and innermost secondaries.

Colours of Soft Parts.—Irides brown or hazel-brown, much the same as in the male; bill, horny-brown; legs, dull-grey or greyish brown nearly always with a tinge of purple or fleshy.

Measurements.—Length, 573 mm. expanse, 762 mm. (Beebe). Wings, 215 to 235 mm., average 18 specimens, 226 mm.; tail, 190 to 211 mm., average 204 mm. Bill from front to tip, 13 to 15 mm.; tarsus, 68 to 74 mm., generally showing an obsolete spur only. The tarsi are very much more slender in the female than in the male.

"Weight, 2 lbs. 4 ozs. to 2 lbs. 10 ozs." (Hume).

Young male and young female are like the adult of the latter sex, but less richly coloured; there is no rufous in the plumage, and the ochre is often pale and whitish on the neck and upper back.

The adult plumage of the male is assumed by degrees, the black and crimson of the head, neck and extreme upper breast and back being first completed, whilst the crimson appears in patches on the wings, scapulars and back and the ocelli make their first appearance as white dots scattered indefinitely here and there. It is interesting to note that at the second autumnal moult when the male acquires the semi-adult plumage, many feathers are assumed which show a transitional stage between the plumage of the young bird and the completely coloured male. Thus, many of the feathers which are mottled in the former and crimson in the latter are at this moult mottled over the greater part but with faint-crimson stains and indefinite pale grey ocelli.

The throat and chin are covered with black feathers, more or less mottled at the base, and the skin, which hardly shows through, is pale and leaden coloured; the lores and sides of the face are also well-covered with short thick black feather.

Chick in down, crown and nape rich chestnut, changing to chestnut-brown on the back and rump and tail tuft; lores, an indistinct supercilium and sides of head and nape pale fulvous, the latter mottled with chestnut; the forehead is brighter and almost an orange rufous. Below pale fulvous or yellow-buff, greyer and duller on abdomen and darker and rufescent on the under aspect of tail tuft. Wings rufous-buff, mottled and barred with blackish-brown; the greater coverts edged with ochre.

Distribution.—Hume gives this bird's Western limits as the Alaknanda Valley in Garhwal, and from that point it extends through Nepal, Sikkim and Bhutan into the Hills N. of the Brahmapootra as far East as Tezpur or Danang. Beebe adds nothing to its known area of habitat, but confirms Hume's record from Alaknanda. Mr. S. L. Whymper, in a letter to me, writes :

> "The exact limits of the two species I do not know, but I have shot *T. satyra* on the East bank of the Alaknanda and *melanocephalus* on the West bank of the Bhagirutti, so that there is a large tract of country unaccounted for; roughly, however, it may be said that the upper waters of the Ganges forms the dividing line."

Nidification.—There is practically nothing on record about the nidification of this bird in a state of nature, though it breeds commonly in captivity. Hume obtained its eggs from natives—he does not say how many—who took them in May in forests below the level of the snows between 9,000 and 12,000 feet or in dense patches of hill-bamboo.

Although these nests were apparently on the ground, I expect that normally it is a tree-nester like the rest of the family. In 1918 I was fortunate enough to receive two birds obtained with their nests in the Chambi Valley, and in both cases the latter had been built in trees. Mr. D. M., who obtained them for me, writes as follows about them :—

> "The eggs of this Pheasant, *Cham-dang* in Tibetan, were taken in the Rhododendron and Oak Forest in the Chambi Valley, and were found in a nest which was built in a tree at about 20 feet from the ground, and quite hidden from view until the hen bird flew from it and so disclosed its position. The two eggs already had signs of chicks in them. The forest here is very thick, but stunted, and the ground much broken up by huge great rocks covered with moss and ferns and ground, trees and rocks seem ever to be wet and damp.
>
> "The nest was just a jumble of very old dead twigs and branches, mostly rotten, and very fragile, perhaps the bird did not built it, but found this old mass of sticks and turned it into a nest.
>
> "The other nest was the same, but empty and lower down in the tree, the men could almost reach up to it.
>
> "The natives tell me that they only lay two eggs as a rule, never more than four and certainly one only sees two chicks with the old birds."

The two eggs sent me with the birds are extremely richly-coloured compared with others in my collection laid in captivity. The ground colour is a pale yellow or buff, but the whole surface is practically covered with a mottling of rich brick-red, making them appear much the same in general colour as a rather dull Perigrine's egg or a richly-coloured Neophrons. One egg, the larger of the two, is considerably brighter than the other, and both are much marked with scratches from the bird's feet. They measure 58·3 × 44·5 mm. and 53·0 × 40·8 mm.

Other eggs laid in captivity and now in my collection measure from 53·0 × 41·0 mm. to 63·0 × 43·8 mm. These are all a dull-pale stone colour, and are much mottled with dull lilac-brown, in each case the markings being numerous everywhere, but more especially so round the centre.

My two wild-laid eggs and some of the others are very round eggs, whilst others are longer and more compressed towards the smaller end. The texture is fairly close, but rather coarse, there is practically no gloss, and the shell is rather thin in proportion to the size of the egg.

Beebe describes the eggs as varying from 61 to 67 mm. in length, and from 40 to 42 mm. in breadth within average of 64 × 41 mm.; his eggs are therefore longer, yet not so broad as those which have passed through my hands.

Eggs in the Tring Museum agree better with mine than with Beebe's, these, four in number, vary from 62·0 mm. to 65·9 mm. in length and from 43·5 mm. to 45·9 mm. in breadth. The smallest egg I have examined both in length and breadth is 53·0 × 40·8 mm. and the biggest 65·9 × 45·9 mm.

According to trustworthy accounts, the breeding season commences about the first week in May and lasts through June, whilst in the highest latitudes a few hard-set eggs may be found as late as the first week in July. My eggs were taken on the 22nd May at nearly 10,000 feet elevation, and an empty nest the next day rather lower down. Beebe says that in captivity birds have been known to lay from mid-April to August, but captive birds are always irregular in this respect, and are equally unreliable in sitting.

The display of the male *satyra* during the breeding season is very fine, but often it is only partial. The bird commences by walking up and down in an excited manner about and in front of the hen, then suddenly it will jump up on to a perch, give its head a shake, let down its lappet and erect its horns. For a few minutes it remains on the perch, the head lowered and advanced with the lappet fully extended to show its brilliant colouring and its deep blue horns erect and gently quivering; the wings may be closed, but more often are slightly extended and shivering. After this it again descends to the ground, and advances to the hen, and once more adopts the attitude of the perch, but now he gradually raises his wings and draws his head back between them, whilst his breast is lowered to the ground, until he eventually resembles a beautiful fan. This attitude is generally persevered in for a few minutes, after which he draws himself up to his full height, drops, and nearly closes his wings, but keeps the lappet fully extended, and his horns well raised. The termination of the show may be closer intimacy with the hen, but more often, a sudden collapse, after which the cock walks about and feeds quietly until once more excited to action.

Frequently the display is only partial, and a full display, such as that described is probably rare; very often during the breeding season the cock bird merely indulges in a vigorous shake of the head, which appears to let loose the lappet, and to erect the horns for a few seconds; sometimes this is followed by a partial or a side view display, and less often by the complete performance.

Anger induces display almost as freely as sexual excitement, but in such cases it is apparently seldom or never complete; I once watched two rival males in adjoining cages, semi-displaying continually, and varying this performance by racing up and down the side of the cage, and glaring disdain at the other.

If the natives' accounts are correct, these birds are strictly monogamous, and the male is a most attentive father and husband, but at present very little is known on this point. Mr. D. M. informs me that "after the eggs are hatched, both cock and hen wander about with their two little chicks, and feed and look after them equally."

The period of incubation is, I think, 26 to 28 days, but Beebe says from 24 to 28 days, and from his own experience cites 26 days as having been the time for a chick to commence cracking its egg prior to emerging.

General habits.—The Crimson Tragopan may be found anywhere between 6,000 and 12,000 feet, according to the time of year, and also the time of day, but as a rule they will not be found wandering much below 8,000 feet, except during very severe winters. In summer they are usually found between 9,000 feet and 11,000 feet. Both the nests which I have already referred to as having been taken for me in Chambi Valley were found at 10,000 feet, and the birds were then also breeding at nearly 2,000 feet higher. The limits of height appear to be the limits of the forest line, and as long as there is ample cover of forest or of the common Ringal Bamboo, the Tragopan may be found whatever the elevation.

They are essentially birds of thick cover, and apparently never wander about on the higher slopes of grass land upon which both the Monal and the Blood Partridges are so often found. Occasionally they may visit the edges of the open land, but they never leave the protection of cover more than for a few yards, and at the slightest sign of danger scuttle back to it. Beebe says that in addition to cover, these birds always seem to require a good water supply. This is probably correct in regard to all the Tragopans, but, on the other hand, practically all over the area inhabited by these birds the forests are very humid, and almost every ravine or hollow has more or less water trickling through it even during the driest months.

They wander about either singly or in pairs during the cold weather, but after the chicks are hatched they remain in family parties until October or November, when they sometimes split up again. About this time the birds wander down a good deal lower than their breeding haunts, and keep well below the snow-line, but even when thus driven down by the cold, the members of each family will sometimes keep together throughout the winter until, in March or early April, they once more wend their way to their summer haunts.

Beebe well describes the various calls of the Tragopan. Writing of late spring, he says:

> "At this season the birds are silent, unless the hen still communicates with her nearly grown young by means of the same low, clucking call which is used when they are chicks. Only when in dire fright or distress, as when suddenly flushed by a dog, do the birds—both cocks and hens—give utterance to a series of loud, raucous notes: *quak! quak! quak! quak!* The call note of the Satyra Tragopan is very distinct from its note of alarm. I have heard it given a number of times by wild birds, and in captivity it is a very characteristic utterance. The male utters it as a herald of his nuptial display—a high, rather quavering báá! báá! báá! báá! When this is heard, the hen is usually near by, and unless something occurs to alarm the birds, a display is almost sure to follow. The hen utters a call comparable to this when separated from her nearly grown young, the call in this instance being given singly, and in a slightly higher, shriller tone."

The defiant challenge trumpet of the Tragopan is a very fine, wild sound. It commences with a short trumpet-like "Wah," followed by three or four more similar calls, each more prolonged than the last, and ending with a long-drawn "wa-a-a-a," too wild and ringing, however, to deserve being called a wail. This call can be heard for an immense distance, especially when uttered in the early dawn of a peaceful Himalayan morning, when it rings across the mist-soaked valleys from one hilltop to another, to be taken up and replied to by other birds in their turn. During the day, except in the height of the breeding season, it is but seldom heard, but as the cool of the evening draws on, it may again be heard uttered at intervals as the birds settle down for the night.

Beebe states that the cock birds only utter this challenge for a very brief period, perhaps two weeks, but this is, I think, a wrong estimate, and I am told by good observers that a cock commences to trumpet before the mating season, and continues, though perhaps not so regularly, to call after the hens have laid. Certainly it may be heard from early April until late in June.

As with so many game-birds, the challenge is usually made from an elevated perch, often comparatively high up in a tree; then when the gauntlet thrown down is accepted, the two birds slowly approach one another, each booming as they make their way towards their rival. What happens when they meet, no one knows for no one has yet seen the possible combat, or, the equally possible result, the mutual showing off, ending in both birds slinking away.

They are much persecuted by the Hill men, who trap and shoot them, both for their plumage and their flesh. The favourite form of trap is the usual little hedge or fence with well-noosed gaps at intervals, through which the birds pass rather than take the slight trouble involved in flying over the obstruction. The birds which are shot are nearly always obtained by calling during the breeding season, and, of course, in this way, it is only the males which can be enticed within shooting distance. The Tibetans, Garhwalis, and Bhutias are all adepts at calling these birds up by imitating their challenge cries, and if a male is within hearing, their success in luring him up is practically certain, though it by no means follows that a successful shot will crown the proceedings. They are extremely wary, even when under the influence of love, and, more often than not, apparently spot the would-be murderer before he has time to fire.

From a sporting point of view, these grand birds seem to be a failure. In the first place they are nowhere numerous enough to make the pursuit of them alone worth while, and in the second, they are such confirmed skulkers, that it is most difficult to get them to fly. It is true that Hume, Beavan and others have recorded them as easy to put up with dogs, but modern birds seem to be more sophisticated than those of the days when these sportsmen wrote. True, if a dog can come on one suddenly in comparatively light jungle, he will take to wing or get up some tree, but as a rule he or she trusts to its legs to take it into safety.

Mr. Whymper writes me:

> " From a sporting point of view, both species of Tragopan are very disappointing; even dogs, accustomed to Hill Pheasants often fail to make them show themselves, though, as the only places I ever saw them in were dense ringal jungles, generally on very steep and broken hillsides, this is not perhaps to be wondered at. However, one never-to-be-forgotten

> morning, the dogs put up a hen Tragopan that came overhead an easy shot, and, as I fired, I became aware of a bird like a gigantic robin red-breast shooting down on me, and with a hasty shot about ten foot in front of him I had bagged a right and left, cock and hen *Tragopan satyra*, the most gorgeous of game-birds."

Occasionally, when walking along the higher hill-tracks, or when wandering along some nullah or ravine, one may tumble on a bird sunning itself in some bare patch, or perched in full view on rock or tree; such chances are, however, but very rare, and the hasty pot shot thus obtained is even less often fruitful of any results.

Beebe states that from the few birds he saw of this species in the few days he devoted to their study he came to the conclusion that the Tragopans roosted far down in the valleys and fed higher up.

This is not quite in agreement with the observations of sportsmen, who have spent many more years than he has days in their haunts. These state that the Tragopans generally roost in the highest part of their individual haunts, so that Beebe's birds must have been exceptional in their habits.

They appear to be almost entirely vegetable feeders, eating all kinds of seeds, shoots and tendrils, and also feeding largely on bulbs and roots, in digging for which they frequently excavate holes of some considerable size.

(*To be continued.*)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XVIII—(*continued*).

REPORT ON THE HOUSE RATS OF INDIA, BURMA, AND CEYLON.

BY

MARTIN A. C. HINTON.

PART III.

(*Continued from page* 416 *of this Volume.*)

NOTE ON THE SKULL MEASUREMENTS.

In Table I are recorded the measurements of all the skulls specially examined for the purposes of this paper. The work was done by means of good sliding calipers, provided with a micrometer screw fine adjustment, and a vernier reading 0.1 mm. accurately. All measurements were made with the utmost care and the finer ones under a watchmaker's glass; many, at long distant dates, were tested by repetition. With this and much other experience of such work I believe that the margin of error is very seldom greater than 0.05 mm. either way.

The dimensions recorded are—

1. Condylo-basal length.
2. Occipito-nasal length (from tip of nasal to most prominent point of occipital surface in mid-line).
3. Greatest zygomatic breadth.
4. Least interorbital breadth.
5. Cranial width, taken just above squamosal roots of zygomata.
6. Greatest distance between temporal lines in fronto-parietal region.
7. Least distance between temporal lines near interparietal.
8. Occipital breadth.
9. Median depth of occiput.
10. Post-molar length; condyle to m^3.
11. Auditory length; condyle to front surface of bulla.
12. Length of a nasal.
13. Greatest combined breadth of nasals.
14. Palatal length; from most forward point of premaxilla to posterior edge of palate—*NOT* including median palatal spine, when present.
15. Length of diastema.
16. Length of anterior palatal foramina.
17. Greatest combined breadth of anterior palatal foramina.
18. Breadth of rostrum in front of infraorbital canal.
19. Least width of outer wall of infraorbital canal ("masseteric plate").
20. Length of molar series; on crowns.

The measurements were all reduced to percentages of the condylo-basal length by slide rule calculation; and then all were averaged. In Table II are given the maximum, minimum and average values of the condylo-basal length, and of the percentages of that dimension yielded by the other measurements. At the foot of the table the least intertemporal distance is expressed in the same way as a percentage of the cranial width.

Table II of course is far more instructive than Table I; yet the latter is the more important—because it is the foundation of my work; it is hoped also that someone else will find it useful as a basis for further work.

TABLE I (*a*).—Measurements of Skulls of Indian Members of *Rattus rattus* groups (in Millimetres).

Dimension No.	*Rattus rattus tistæ*, Pashok.														*R. rattus* subsp., Jalpaiguri.	*Rattus rattus bhotia.*							
	Pure white bellies and Intermediate.					Slaty bases to hairs.					Narbong	Rongli.		Gangtok.		Hasimara, Bhutan.							
	393 ♀	234 ♀	335 ♀	243 ♀	482 ♀	689 ♀	414 ♀	288 ♂	325 ♂	625 ♂	153 ♀	141 ♀	137 ♂	143 ♂	154 ♀	1241 ♂	980 ♀	1221 ♂	1140 ♂	1125 ♂	1208 ♂	1048 ♂	1185 ♂
Teeth : State of Wear :—	½	½	much	½	½	sl.	sl.	½	mueh	mueh	mod.	½	½	w. out.	½	mod.	mod.	mueh	mod.	mod.	½	½	½
1	36·8	37·1	37·6	38·8	38·9	36	36·2	37·4	38·9	39·8	37·5	37 3	38·5	40·2	40·8	35·1	36·9	37·1	37·4	37·8	38·3	38·1	38·9
2	39·2	39·8	39·8	40·8	41·3	38·7	39·5	..	41·5	42·1	39·3	38·8	40·1	41·4	43	37·1	39·4	39·3	40·2	41	41	40·5	40·8
3	19·4	20·1	19·6	19·9	20·6	19·3	19·6	19·7	20·7	21·1	19·9	20·2	20·3	20·8	20·3	18·8	19	19·4	19·4	20·2	19·7	19·2	20·1
4	5·6	5·7	5·7	5·6	5·6	5·6	5·5	5·7	5·9	5·9	5·9	5·4	5·7	6	6	5·2	5·5	5·4	5·3	6·1	5·3	5·8	5·8
5	15·6	16	15·7	16·2	15·6	15·5	16	15·2	16·5	16·6	15·6	16·1	16	16·2	16·3	15·3	15·3	15·5	15·7	16·1	16·4	16·1	16·1
6	13·2	14·3	13·4	14·1	13·8	13·9	14	12·8	14·3	14·4	14·7	13·9	14·1	13·8	14·5	13·3	13	13·6	13·6	14·5	14·2	14·4	14·4
7	12	12·9	11·5	12·6	..	12·5	11·4	11·5	13·1	12·9	13	12·5	12·5	12	12·6	12·3	11·4	13·2	11·7	12·2	12·1	13·4	12·6
8	15·6	15·4	14·9	15·8	15·4	15	15	15·2	16·1	16·1	15·6	15·1	15·4	16·1	..	14·7	15·1	15·2	15·4	15·7	16	15·9	15·9
9	9·2	9·2	9·1	9·2	9·1	9·1	9·2	9·4	9·6	9·5	8·9	9·6	9·4	9·3	9·8	9	9·3	8·8	9	9·6	9·5	8·9	9·7
10	16·5	16·4	16·9	17·3	17·5	15·9	16·2	16·4	17·4	17·8	16·6	16·4	18·4	18·5	18·5	15·8	16·8	16·5	16·9	17·1	17·4	16·9	17
11	10·1	9·9	10·1	10·5	9·7	9·8	9·7	9·9	10·1	11	9·9	9·7	10·5	10·9	11·3	9·4	9·8	9·9	10·1	9·9	10	10	10·2
12	14·2	14·8	14·9	14·8	15·5	13·6	14·3	13·7	15·1	15·6	14·5	14·3	14·3	15·1	16	13·5	14·6	14	14·8	15·3	14·4	14·6	14·6
13	3·9	3·8	4·2	4·4	4	3·8	4	3·8	3·7	4·1	4	4	3·8	4·1	4·2	3·7	3·7	4	4·1	3·8	3·7	3·9	4·2
14	21·2	21·5	22·1	22·9	22·5	20·9	20·6	21·6	22·8	23	22	22	21·8	23·2	23·5	20·6	21·2	21·4	21·5	22	22·4	22·2	22·8
15	10·3	10·6	10·7	10·8	10·7	9·4	9·6	10	10·8	11·3	10·2	10·7	10·1	11·4	11·2	9·4	9·5	9·8	9·9	11	10·4	10	10·6
16	6·9	7·1	7	7·5	7	6·9	6·4	6·9	7·8	7·8	7·1	7·3	6·9	7·7	8	7	6·8	7·4	7·1	7·4	7	8·2	7·4
17	1·9	2·4	2·3	2·4	2·4	2·1	2·1	2·2	2·4	2 6	2	2·4	2·4	2·2	2·4	2·3	2·1	2·1	2·1	2·2	2 2	2·2	2·1
18	7·2	7	7·2	7·3	7·3	7	6·8	7·1	6·9	7·9	7	7·2	7·3	7·5	7·4	6·6	7	7·1	7	7·3	6·8	6·9	7·3
19	4·1	4·5	4·4	4·2	4·2	4	4·8	4·2	4·6	4·7	4·4	4·2	4·4	4·3	4·6	4·2	4·1	3·7	4·2	4·5	4·4	4·8	4·4
20	6·9	6·6	6·1	7·1	7·1	7	7	7·6	6·9	7	6·7	6·6	6·5	6·6	7	6·6	7	6·5	7·1	6·6	7	7·3	7·3

TABLE I (*b*).—Measurements of Skulls of Indian Members of *Rattus rattus* groups (in Millimetres)—*contd.*

Dimension No.	*Rattus rattus arboreus.*								*Rattus rattus narbadæ.*							*Rattus rattus girensis.*				*Rattus rattus sataræ.*			
	Bihar and Orissa, B. M. 15·4·3.								Central Provinces, B. M. 12·11·29.							Kathiawar, B. M. 13·8·8.				Koyna Valley, B. M. 15·7·3.			
	·98 ♂	·96 ♀	·88 ♂	·99 ♀	·90 ♀	·94 ♂	·91 ♂	·89 ♂	·129 ♂	·135 ♂	·138 ♀	·134 ♀	·137 ♀	·132 ♀	·922 ♀	·124 ♀	·122 ♂	·123 ♂	·125 ♀	·56 ♀	·58 ♀	·55 ♂	·57 ♀
Teeth : State of Wear :—	½	½	½	½	½	much	½	w. out.	mod.	½	½	½	½	w. out.	much	mod.	½	½	w. out.	½	½	½	½
1	38·3	39	39·2	39·4	39·6	39·7	40·3	40·3	36·9	37·4	37·7	38·3	38·7	39·3	40·5	34·4	37·3	37·6	39·2	39·3	39·5	39·8	40·1
2	40·6	41·2	41	41·1	41·2	41·9	42·5	42	38·9	39·8	40	40·5	41	41·8	42·6	37·4	39·6	39·8	41·3	42·5	42·7	42·9	42·6
3	20·1	20·3	20·3	20·5	20·8	19·7	21·7	20·8	18·7	18·2	18·6	18·9	19·7	19·9	20·7	17·5	18·8	19·1	..	19·3	19·8	19·8	20·2
4	6·2	5·7	5·7	6·3	6·1	5·9	5·7	5·9	5·5	5·9	5·9	5·5	6·2	6	6·3	5·1	6·2	6	6·1	5·8	5·8	5·9	5·8
5	16·1	16·5	15·9	16·6	15·9	15·9	17	16·5	16	15·5	15·3	15·4	16·1	16·4	15·8	14·6	15·8	15·5	16	16·5	16·7	16·9	17·2
6	14·1	14·1	14·4	14·2	13·7	12·9	14·4	14·4	14·4	14·3	14·1	13·9	13·9	14·5	13·5	12·8	14·1	13	13·8	15·5	15·7	15·6	15·6
7	12	12·2	12·2	12·2	11·7	11·6	12·6	12·5	13·6	12·6	11·9	13·1	12·2	12·1	11·6	11	11	12·1	12·1	12·3	13·3	13·5	12·6
8	15·9	15·7	15·8	15·8	15·8	15·1	16·5	16·6	15·5	15·1	15·1	15·3	15·8	15·4	16·7	14·2	14·8	14·9	15·5	15·4	16·2	15·9	16·2
9	9·6	9·6	9·5	9·7	9·4	9·2	9·9	9·4	9·2	9·4	9	9·3	9·5	9·6	9·2	8·5	9	9·1	9·2	9·7	9·6	9·5	9
10	17·8	18·4	18	18·4	18·2	18·6	18·6	19	17·4	18	17·7	17·7	18	17·7	18·4	15·8	17·5	17·6	17·8	17·3	17·7	17·9	17·7
11	10·3	10·6	10·9	10·3	10·7	10·8	11·2	10·9	10·2	10·5	10·2	10·5	10·7	10·8	10·7	9·2	10·3	10·4	10·5	9·9	10·1	10·4	10·7
12	14·5	15·1	14·8	14·4	15·5	14·9	15·1	15·4	14	14·1	14·2	14·3	15	15·2	15·8	13·4	14·7	14·2	14·7	15·5	14·8	15·5	15·5
13	4·2	4·2	4·2	4·2	4·3	4·5	4·4	4·4	3·7	4	4	3·7	4·3	4·5	4·6	3·4	4	4	4·1	4	3·8	4	4
14	22	22·2	22·7	22·5	23·3	22·7	23·1	23·1	21·2	20·6	21·3	21·3	21·6	22·6	22·9	19·6	21	21	22·6	23	23	23·2	23·7
15	10·7	10·5	11·3	10·8	11·6	11·7	11·4	11·5	10·2	10·1	10·4	10·4	10·7	11·4	11·5	9·6	10·2	10	11·1	11·2	10·9	11·7	11·4
16	7·5	8	7·4	7·5	8	8	8	8	6·7	7·3	7·3	7·7	7·1	7·7	8	7·2	7·8	7·2	8·2	8	7·8	8·7	7·8
17	2·5	2·5	2	2·8	2·7	2·4	2·9	2·4	2·4	2·6	2·6	2·6	2·6	2·7	2·8	2·5	2·4	2·7	2·7	3·2	2·7	3	2·9
18	6·9	6·9	6·9	7·3	7·2	7·2	7·7	7·5	6·7	6·6	7·2	6·9	7·1	7·5	8·1	6·2	6·6	7	7·2	7	6·7	6·9	6·8
19	4·3	4·1	4·3	4·6	4·5	4	4·1	4·3	4	4	4·1	3·9	4·1	4·1	4	3·7	3·8	4	4	3·9	4·2	3·9	3·9
20	6·4	6·4	6·4	6·8	6·4	6	6·7	6·3	6·3	6	6·1	6·7	6·2	6·1	6·6	6·2	6·1	6·1	6·2	7	7	6·6	7

TABLE I (*c*).—Measurements of Skulls of Indian Members of *Rattus rattus* group (in Millimetres)—*contd.*

Dimension No.	*Rattus rattus wroughtoni.*																				
	Dharwar, 12·6·29.		N. Mysore and Kanara, B. M. 12·11·28.				S. & E. Mysore, B. M. 13·4·11.			Coorg, 13·8·22.		Coonoor, B. M. 98·3·5.			Travancore, B. M. 95·10·9.						
	·100	·102 ♂	·117 ♀	·114 ♀	·113 ♂	·115 ♀	·97 ♀	·91 ♂	·87 ♀	·72 ♂	·73 ♀	·24 ♂	·26 ♂	·22 ♂	·39 ♂	·30 ♂	·33 ♀	·34 ♂	·35 ♀	·36 ♂	5·11·26·1
Teeth : State of Wear :—	mod.	½	½	much	½	½	½	much	½	mod.	½	½	½	much	½	much	much	mod.	½	mod.	mod.
1	37·7	37	38·9	39·2	39·3	40·2	38·6	40·3	40·9	38·6	43·2	36	38·5	39·4	36·6	38·5	38·6	36·1	36·9	37·8	36·9
2	40·3	39·7	41·1	42	42	42·7	40·6	42·6	43·4	40·6	45·4	38·2	41·4	42	39·2	41·3	41·2	39·2	39·5	40·7	39
3	19·5	19·3	19·8	19·5	19·3	20·5	18·9	20·2	20	18·6	21·2	18·5	20·4	19·6	19·1	19·6	19·2	18·7	18·7	19·7	18·5
4	5·7	6	6·4	6·3	6	5·9	5·9	6·2	6	6·4	6·5	5·7	6	5·9	5·6	5·6	6·1	5·8	6·1	5·7	5·6
5	15·9	16·3	16	15·8	15·7	16	15.6	15·6	15·7	15·7	17·6	15·1	15·8	16·5	15·6	15·8	16	15·6	16	16·3	15·5
6	14·4	14·7	14·1	15·1	14·1	14	13.9	14·1	13·8	13·7	15·5	12·9	14·1	14·3	14	14·1	14	14·4	14·4	14·9	14·6
7	12·5	12·7	13	13	12·4	12·6	12.2	12·1	12·6	12·2	13	11·5	12·3	13·9	13	12·4	12·4	13	12·6	13·6	12·6
8	15·9	15·8	15·6	15·6	15·5	16·4	15	16·1	16·5	15·4	17·2	14·6	15·8	16	14·9	14·4	15·5	14·5	15·2	15·7	14·6
9	9·1	9·4	9·1	8·8	9·1	9·6	9·2	9·8	9·9	9	10·1	9	9·8	9·5	9	9·1	9·8	9·3	9·3	9·6	9·1
10	18	17	18·1	18·4	18·3	18·8	18·3	19·1	19·7	17·8	19·4	17	18·4	18·6	17·2	18·1	18·2	17	17·2	17·5	17·3
11	10·8	9·5	10·5	10·6	10·6	10·8	10·6	11	11·3	10·1	11	10·2	10·7	10·5	10·2	10·1	10·5	9·9	9·7	10·3	10·4
12	14·4	14·3	15	15	14·9	15·2	14·4	15	15·9	15·2	16·9	13·7	14·5	15·7	13·5	15·3	15·4	14	14·2	14·5	14·1
13	3·9	4·2	4	4·1	4·1	4	4	4·5	3·8	4·1	4·5	4·1	4	4·3	3·6	4·3	4·2	4	4·3	3·9	3·9
14	20·9	21·3	22·3	22·1	22·2	22·5	21·8	22·9	23·1	22·3	25·3	20·6	21·9	22·7	20·6	22·2	21·6	20·1	21	21·7	20·7
15	9·9	10·5	10·7	10·8	10·8	11·4	10·5	11·3	10·9	10·9	12·5	9·9	10·7	10·9	9·4	11·2	10·7	9·8	10·5	9·9	10·4
16	7·3	7·6	7·6	7·3	8	7·5	7·5	8·4	7·9	7·4	8·6	6·6	7·3	7·7	6·8	7·4	7·4	7·2	6·7	7·8	7·5
17	2·6	2·5	2·9	2·7	2·7	2·5	2·8	3·2	2·6	2·8	3·1	2·7	2·7	2·8	2·4	2·6	2·6	2·4	2·5	2·4	2·7
18	7·1	7·3	7·6	7·5	6·9	7·4	7·5	7·3	7·3	7·4	7·6	6·8	7·6	7·9	6·9	7	7·1	6·7	7·1	6·8	6·9
19	3·8	3·8	3·7	4·2	3·9	4	4	3·7	3·9	3·9	4·5	3·3	4	4	3·8	3·8	3·8	3·4	3·8	4·1	3·6
20	6·2	6·3	6·6	6·5	6·6	6·4	5·9	6·1	6·5	6·3	7·4	5·8	6·2	6·1	6·2	5·9	6	6	6	6·4	6

TABLE I (*d*).—Measurements of Skulls of Indian Members of *Rattus rattus* group (in Millimetres)—*contd.*

Dimension No.	*Rattus rattus kandianus.*								*Rattus rattus yangutrianus.*								*Rattus rattus sikkimensis.*							
	Ceylon, B. M. 15·3·1.								Kumaon, 14·7·10.								Pashok.							
	·202 ♀	·189 ♀	·190 ♂	·193 ♀	·205 ♂	·467 ♂	·191 ♂	·215	·134 ♀	·113 ♀	·115 ♀	·119 ♀	·116 ♂	·126 ♂	·127 ♂	·133 ♂	·236 ♂	·473 ♀	·286 ♂	·502 ♂	·426 ♀	·511 ♂	·677 ♀	·645 ♂
Teeth : State of Wear :—	mod.	mod.	mod.	½	½	½	much	mod.	mod.	½	much	½	½	mod.	½	w. out.	much	½	½	mu-ch.	mu-ch.	½	mu-ch	½
1	34·1	36·9	38·6	39	39·7	36·5	42·7	39·1	38·4	39	39·4	39·7	41·5	42·2	42·9	43·4	39·4	40·1	40·3	41·1	41·4	41·7	43·1	44·2
2	37	39·4	42	42·7	43	..	47	42·4	40·9	41·7	42·3	42·2	44·4	44·5	45·4	45·7	41·4	41·6	42·6	43·1	42·1	44·2	44·6	45·6
3	17·4	18·8	19	20·3	18·8	17·8	20·9	19·7	19·7	20·3	20	19·8	20·2	20·6	21	21·3	20·3	20·5	20·3	21·2	21	21·7	22·3	22·6
4	5·3	5·7	6·6	6·2	5·9	5·6	6·4	6·6	5·8	5·7	5·9	6·1	6·3	6·3	6·3	6·5	5·5	6·1	6	6·1	6·2	6·8	6·2	6·5
5	14·7	15·4	16·2	17·3	16·2	15·2	17·7	16	16·4	16	16	16.5	16·5	16·5	17·1	16·9	15·6	16·6	16·8	16·6	16·7	16·6	16·9	17·1
6	12·3	14·1	14·4	15·7	14·4	13·9	16·4	14·1	13·7	13·8	13·8	14.8	15·1	15·3	15·5	14·3	13·1	13·8	14·4	14·5	13·5	14·4	13·9	13·9
7	11·1	11·8	..	14·4	13	..	13·5	12·7	12·3	12·3	12·2	12.8	13·5	13·9	13·1	12·6	..	11·4	11·2	10·7	10·6	11·7	11·4	10·9
8	14	15·2	15·7	16·4	15·6	14·8	16·7	14·9	16·2	15·7	15·3	16	16·6	17·1	16·9	17·2	15·6	16·2	15·7	16·3	16·1	16·5	16·3	16·9
9	8·6	8·9	9·3	9·3	9·7	9	9·8	..	9·6	9·8	9·6	9·4	9·4	10·1	9·8	10·2	9·2	9	9·4	10	9·9	9·6	9·7	10·1
10	16	17·2	18	17·6	18·6	17·1	19·1	18·1	17·1	17·7	18	17·7	19	19·6	19·6	20	17·8	17·8	18·8	18·4	18·7	18·6	20	20·1
11	9·1	10·1	10·2	9·8	10·5	9·6	10·7	10·2	10·3	10·5	10·8	10·8	11·2	11·6	11·4	11·4	11·1	10·4	10·5	10·7	10·5	10·8	11·4	11·3
12	13·3	14·1	15·1	16·1	15·1	13·9	18·8	16·2	14·4	15.8	16·9	15·6	15·8	16·4	16·9	17·1	14·8	15·7	15·4	16·4	15·8	16·5	17·1	17·1
13	3·8	4	4·4	4·8	4·6	4·4	4·6	4·8	4·5	4·3	4·2	4·5	4·4	4·5	4·4	5	4·2	4·5	4·2	4·5	4·5	4·7	4·5	5
14	19	20·5	22	22·8	22·6	..	24·8	22·4	22·5	22	22·4	23·2	24	24	24·6	24·7	22·8	23·8	22·8	24	23·8	24·2	24·6	25·4
15	8·9	10·3	10·9	10·9	11·4	9·8	12·3	10·7	10·4	10·7	11	11·2	11·7	11·4	12·4	11·8	11	11·6	10·8	11·3	11·4	11·6	12·1	12·1
16	6·8	7	7·7	7·6	8·7	7·5	8·9	7·6	7·8	7·8	8·1	8·5	8	8·4	9	8·2	7·7	7·8	7·8	8·1	8·2	8·3	8·2	8·4
17	2·3	2·4	3·1	3·1	2·8	2·7	3	2·6	2·6	2·5	2·6	2·6	2·6	3	2·7	2·7	2·4	2.5	2·8	2·9	2·6	2·9	2·7	3·3
18	6·6	6·8	7·5	7·6	7·6	6·7	7·9	7·2	7·3	7·1	7	7·1	7·6	7·1	7·7	8	7·3	7·5	7·1	8	7·4	8	7·4	8·1
19	4·1	3·9	3·8	4	4·3	3·8	4·2	4·1	4·4	4·1	4·1	4·6	4·7	4·5	4·4	4·4	4·7	4·2	4·4	4·5	4·6	4·4	4·5	4·7
20	5·8	5·8	6·3	6·5	6·1	6·2	6·9	6·6	7·1	6·7	6·7	7	6·8	7·2	7	7·4	6·5	7	7·1	7·5	7·1	7·5	7	7·6

TABLE I (*e*).—Measurements of Skulls of Indian Members of *Rattus rattus* group (in Millimetres)—*contd.*

Dimension No.	Hasimara, Bhutan.	Jalpaiguri, Bengal ?	Ringin.	Singhik.	*Rattus rattus sikkimensis.*					*Rattus rattus khyensis.*													
					Rongli.		Gopaldhara.			Chin Hills, B. M. 16·3·26.				North Shan States. 14·7·18	Mt. Popa, 14·7·19.		Pegu.					Chindwin Kin, 15·5·5.	
	1064 ♀	·155 ♀	·146 ♂	·145 ♀	·140 ♀	·138 ♂	96 ♀	61 ♀	64 ♂	·55 ♂	·57 ♀	·56 ♀	·54 ♂	·39 ♂	·159 ♂	·160 ♂	568 ♂	655 ♀	734 ♀	671 ♂	673 ♂	5311	·228
Teeth: State of Wear:—	½	much	½	½	½	½	½	½	½	mod.	sl.	mod.	½	½	½	½	sl.	mod.	½	½	much	mod.	much
1	41·5	39·8	37·5	39·5	39·5	42·5	38·3	40·9	41·7	35·8	36·4	38·7	38·5	42·8	38·2	38·4	36·8	34·7	38·1	40·1	37·8	36·9	40·7
2	43·6	40·6	39·6	41·5	41·4	44·8	40·8	42·6	44	39·1	38·4	41·5	40·1	45·1	40·2	40·4	40·2	37·7	39·7	42·3	40·5	39·3	43·6
3	22	21·1	19·1	20·4	19·8	21·5	20·2	21·6	21·6	18·4	17·8	20·7	19·7	21·3	19·6	19·8	17·3	18·4	18·7	19·2	19·3	17·5	21
4	6·1	6	5·4	5·7	6	6·1	6·3	6·2	6·6	5·3	5·5	6·2	5·6	6	6·2	5·9	5·3	5·9	6·3	6·2	5·8	5·2	5·9
5	16·5	15·8	15·5	16·4	16	16·5	16·8	17·2	17	15·5	15·5	16·3	15·7	16·8	15·8	15·5	14·7	15·9	16·4	16·2	15·3	15·3	16·1
6	13·9	13·3	13·2	13·9	13·6	14·4	14·3	14·6	13·9	13·4	13·3	14·4	14·7	14·8	14	14·9	13·8	14·5	14·3	14·6	13·9	14	13·3
7	10·6	10·9	10·4	11	10·7	..	11·3	12·5	10·8	11·5	12·2	12·6	12·6	12·5	12·6	11·7	11	12·7	12·7	12·3	12·1	11·7	10·9
8	16·1	15·5	15·2	15·3	15·6	16·1	15·6	16·7	16·8	15·3	15·3	15·4	15·3	16·8	15·8	15·8	14·5	15·1	16	16·1	15·3	14·4	16·2
9	9·7	9·3	9·1	9·6	9·5	9·6	9·4	10·2	9·7	..	9·1	9·1	..	10	9·3	9·2	8·7	9·3	9·2	10·2	9·5	9	9·8
10	18·6	17·5	16·4	17·3	18	19·1	17·2	18·7	18·7	16·1	16·3	17·7	16·5	20·3	17·8	17·6	17	15·6	17·5	18	17·1	16·8	18·7
11	10·6	10·4	9·7	9·7	10·5	10·9	10·2	10·8	10·6	10·2	10·2	10·3	10	11·4	10·7	10·2	9·8	9·5	10·6	10·6	10·3	10·5	10·7
12	16·8	14·4	14·8	15·5	15·1	16·7	14·4	15·1	16·7	14·1	13·7	14·6	15·2	16·4	14·3	14·6	13·3	13·6	13·7	15·3	13·5	13·6	16·5
13	4·5	4·1	4·2	4·3	4·1	4·7	4·2	4·7	4·5	4·1	4	3·8	4·2	4	4·5	4·7	4	3·9	4·1	4·3	4	3·9	4·2
14	24·4	23	21·9	23·4	23·2	24·7	22·3	23·8	24·3	20·4	20·8	22·6	22·3	24·5	22·2	22·4	21	19·9	22	23·4	22	21·1	23·3
15	11·7	11·3	10·2	11·1	10·8	11·8	10·8	11	11·7	9·2	9·6	10·4	10·3	11·8	10·3	10·7	10·3	9·1	10·3	11·7	10·8	10	10·7
16	8·5	7·9	7·1	7·7	7·7	8·4	7·5	8·3	8·1	7	6·6	7·7	7·2	8·4	8·1	7·4	7·2	6·1	7·5	7·8	7·4	7·6	7·2
17	2·8	2·6	2·5	2·6	2·6	2·7	2·4	2·8	2·7	2·4	2·1	2·5	2·3	2·3	2·3	2·7	2·3	2·2	2·2	3	2·3	2·5	2·2
18	7·6	7·8	6·6	7·2	7	8	7	8	7·4	6·8	6·7	7·1	7·1	7·6	7	7·2	6·4	6·4	7·4	7·4	7·1	6·9	7·5
19	4·5	4·5	4·3	4·5	4·1	4·4	4·2	4·4	4·6	4·1	3·8	4·3	4·5	5·1	4·2	4·4	4	4	4	4·6	4·3	4	4·2
20	7·3	7·1	7·3	7·1	7	7·3	6·9	7·3	7·2	7·4	6·7	7·1	7	7·2	6·3	6·6	6·3	6·8	7·2	6·7	6·5	7	6·9

TABLE I (*f*).—Measurements of Skulls of Indian Members of *Rattus rattus* group (in Millimetres)—*contd.*

Dimension No	*Rattus rattus tikos.*							*Rattus rattus tatkonensis.*									*Rattus rattus rufescens.*					
	Tonasserim, 14·12·8							Chindwin.			North Shan States.	Mingun.					Kumaon, B. M 14·7·10					
	·170 ♂	·175 ♂	·179 ♀	·172	·168 ♂	·182 ♂	·167 ♂	·224 ♂	·225 ♂	·229 ♂	·37 ♂	·170 ♀	·168 ♂	·169 ♀	·167 ♂	·164 ♀	·107 ♂	·108 ♀	·101 ♀	·110 ♀	·106 ♀	·109 ♀
Teeth : State of Wear :—	½	½	much	much	much	½	much	½	mod.	mod.	½	½	much	½	½	½	½	½	½	½	½	½
1	39·4	39·5	39·7	39·8	40·7	40·9	41·9	40	37	37·6	40·9	37·9	40·9	39·1	40·1	41·8	36·8	38·2	39	39·2	39·6	40·2
2	41·8	41·8	41·4	42·7	42·7	42·4	44·3	42·6	39·5	40·3	43·5	40·4	43·1	41·4	43·1	43·5	38·3	40·7	41·5	41.6	42·3	42·5
3	19·6	19	18·8	20·2	20·3	19·8	19·4	19·4	18·6	20	20·8	19·5	20·2	21·4	20·5	20·8	19·5	19·7	20·7	20·6	20·6	21·1
4	6·4	6·4	6·6	6·4	6	6·4	5·6	5·8	5·6	5·3	6	6·1	6·1	6·2	5·7	6·1	5·5	6·2	6	6·3	6·1	6·9
5	15·9	15·6	16	16·7	16·5	15·8	16·4	16·1	15·7	15·4	16·7	15·8	16·2	16·1	15·8	16·5	15·6	16·5	15·6	16·7	16·7	16·8
6	15·1	13·7	14·9	15	14	14·7	14·3	14·4	14	13·6	15·3	14·8	14·7	14·3	14·2	14·3	14·4	14·4	13·5	14·7	14·6	15
7	12·6	12·6	12·1	13·2	12·1	13	11·9	13·1	12·7	12·4	12·7	13	11·8	12·6	11·8	12·1	12·5	12·4	11·5	13·1	11·8	12·5
8	15·5	15·8	15·6	16·8	16·3	15·7	16·5	16·4	15·8	16·1	16·2	16·2	16·1	16·4	15·9	17·1	15·4	15·7	15·6	16·8	15·7	16·2
9	9·4	8·9	9·6	10·1	9·5	10·1	10·1	10	9·4	9·2	9·8	9·1	9·8	9·2	9·5	10	9·5	9·5	9·3	9·4	10	9·9
10	18·2	18·1	17·9	18·7	18·9	18·6	19	18·9	17·2	17·1	19·6	17·3	18·2	17·8	18·1	19·5	17·1	17·7	18·5	18	17·8	18·8
11	10·8	10·8	10·9	11·6	10·7	10·7	11·7	11·2	10·7	10·7	10·7	10·4	10·8	10·3	10·9	11·4	10·3	10·3	10·2	10·7	10·2	10·7
12	14·7	15·8	14·8	15·7	16·1	15·3	15·7	15	14·5	14·7	15	13·8	15·7	14·8	16·1	16	13·1	15·2	14·7	14·7	15·7	15·2
13	4·2	4·6	4·6	4·6	4·4	4·9	4·7	4	4·1	4	4·1	4·1	4·3	4·6	4·5	4·4	3·8	4·3	3·8	4	4·4	4·1
14	22·8	22·9	22·6	22·3	23·3	21	24·6	22·8	21·2	21·7	22·9	21·4	24·2	22·7	23·3	24·3	20·9	22·2	22	22·4	23·1	22·7
15	11·1	11·4	10·9	10·7	11·1	11·3	11·6	11·1	10	9·8	11	10·1	11·7	10·6	10·9	11·2	10·1	10·8	11	11	11·1	11·5
16	7·4	8·2	7·7	8·2	8	7·5	8·5	8·4	7·1	7·1	7·2	6·9	8	7·1	7	8·4	7·4	7·4	7·6	7·5	8·3	8·1
17	2·3	2·8	2·6	2·9	2·3	2.7	2·5	2·3	2·3	2·2	2·8	2·7	2·6	2·4	2·6	2·6	2·3	2·6	2·7	2·8	2·6	3·2
18	6·9	7·3	7·5	7·8	7·2	7.4	7·4	7	6·4	6·7	7·4	7	7·7	7·3	7·7	7·3	6·8	7·1	6·7	8·1	7·2	8
19	4·6	4·3	4·7	4·6	4·4	4.4	4·3	4·3	3·8	4·1	4·6	4·4	4·6	4·2	4·4	4·6	3·7	3·8	4·7	4·3	4	4·4
20	6·8	6·4	7	6·7	6·8	7.1	7	6·6	7·3	7	6·5	6·8	6·9	6·8	7·2	7·3	6·2	6	6·2	6·7	6·9	6·5

TABLE I (*g*).—Measurements of Skulls of Indian Members of *Rattus rattus* group (in Millimetres)—*contd.*

Dimension No.	*Rattus rattus rufescens.*—contd.																			
	Central Provinces, B. M. 12·11·29								Nimar, 12·6·28.		Khan-desh.	Gwalior, B. M. 15·7·2				Kathiawar, 13·8·8				
	·116 ♀	·115 ♀	·114 ♂	·113 ♂	·119 ♀	·123 ♂	·126 ♀	·124 ♂	·32 ♀	·33 ♀	·21 ♂	·17 ♀	·18 ♀	·16 ♂	·15 ♂	·120 ♀	·121 ♂	·119 ♂	·116 ♂	·117 ♀
Teeth : State of Wear :—	mod.	mod.	mod.	½	½	½	much	½	½	½	½	½	mod.	much	½					
1	36·3	37·5	37·8	37·8	38·2	38·7	40·5	40·5	37·3	37·8	43·3	35·6	38·5	39·1	39·1	36·4	36·4	37	37	38·1
2	38·9	39·9	40·4	40·8	40·4	41·2	42·5	42·4	39·2	40·5	45·5	37·7	40·6	41·4	41	38·6	39·7	39·2	40·2	40·2
3	18·6	19·7	18·7	18·5	18·8	19·4	20·8	20·5	18·7	19	..	18·5	20·4	20·3	20·7	18·4	18·6	19·2	18·7	19
4	5·7	5·9	5·8	5·7	5·5	5·8	6·8	6·6	5·9	5·3	6·3	5·9	5·4	6·2	6	5·3	5·9	5·6	5·7	5·8
5	15·5	16·2	15·3	15·7	15·2	16·3	16·4	16·6	16·7	15·5	16·7	15·7	15·5	16·7	16·2	15	15·8	15·6	15·7	15·8
6	13·9	13·8	13·5	14·7	13·7	13·8	14·1	15·1	14·4	14·4	14·1	14·5	13·2	14·7	14·6	12·8	14·3	13·9	14·4	13·5
7	12·7	12·2	11·8	13	11·8	11·8	12·3	12·6	13	12·6	13·3	12·4	11·7	13	12·3	11·6	12·5	12·7	12·3	12
8	15	15·2	15·2	15·7	14·8	16	16	17	15·6	15·4	17·6	14·9	16·4	16·7	16	14·9	15·3	15·7	15·5	15·4
9	9	9·2	9	9·1	9·3	9	9·7	9·8	9·4	9·5	10·2	8·9	9·5	9·8	9·6	8·6	8·9	9·2	9·3	9
10	17	17·2	17·6	17·1	17·7	17·8	19	18·8	17·1	17·6	20·2	16·6	18·8	17·8	19	17	16·8	17·1	18·1	18·5
11	9·9	10·2	10·6	10·2	10·2	10·2	10·7	10·8	10·4	10·3	11·3	10·1	10·3	10·3	10·7	10	9·9	10·4	10·2	11
12	14·3	14·6	13·8	14·7	14·5	15·2	15·8	15·3	13·6	14·7	16·8	13·7	14·5	15·1	15·3	14·2	14·4	14	14·2	15
13	3·9	4·3	3·8	3·7	3·9	4·4	4	4·3	3·8	3·9	4·6	3·6	4·2	4·3	4·1	3·6	3·7	4	3·6	4
14	20·5	21·5	21·3	21·8	21·6	22	22·7	23	20·8	21·3	..	20	21·3	22·6	21·9	20·7	20·8	20·7	20·4	21·1
15	9·8	10·4	10·2	10·6	10·5	10·6	11·5	11·5	10·6	10·5	12·5	9·5	10·7	11·4	11	9·9	10·2	10·5	9·9	10·2
16	7·2	7·6	7·4	8	7·6	8·2	8·3	7·7	7·5	7·5	8·9	7	7·8	7·7	8·2	7·3	7·4	7·1	7·2	8
17	2·4	2·4	2·4	2·4	2·4	2·3	3	2·9	2·6	2·3	3	2·8	2·8	2·7	2·9	2·5	2·6	2·6	2·4	2·7
18	6·4	7	7·1	6·6	6·5	7·2	7·4	7·5	7·2	6·8	8·1	6·8	7·1	7·6	7·1	6·5	6·5	6·8	6·4	7·3
19	3·8	3·9	4	3·8	3·9	4·7	4·1	4·5	3·9	4	4·5	3·6	3·9	4·1	4	3·6	3·7	3·9	3·8	3·7
20	6·3	6·4	6·6	6·5	6·1	6·6	6·4	6·4	6	6·4	6·3	6·2	6·1	6·1	6·1	6·5	6	6	6·1	5·8

TABLE I(*h*).—Measurements of Skulls of Indian Members of *Rattus rattus* group (in Millimetres)—*contd.*

Dimension No.	*Rattus rattus rufescens.*—contd.																						Coonor.
	Cutch, 12·10·4.						Palanpur, 13·9·18.			Koyna Valley, 15·7·3.			Dharwar, B. M. 12·6·29.		N. Mysore and Kanara.			S. and E. Mysore.					
	·66 ♂	·70 ♀	·68 ♂	·67 ♂	·69 ♀	·71 ♀	·69 ♂	·66 ♂	·68 ♀	·54 ♂	·51 ♂	·53 ♀	·96 ♀	·93 ♂	·108	·105 ♂	·110 ♀	·96 ♀	·95 ♂	·94 ♀	·83 ♂	·88 ♀	·23 ♂
Teeth : State of Wear :—	mod.	½	mod.	mod.	½	½	½	½	much	sl.	mod.	½	much	½	much	½	mod.	mod.	½	mod.	½	½	½
1	37·2	37·3	37·5	37·9	38	38·7	37·4	41·1	40·4	36·9	39	40	36·1	39·6	39·7	41·1	34	36·9	39	36·9	38	38·3	36·2
2	40·4	38·9	40·3	40·9	40·4	41·3	40·1	43·1	42	39·4	41·3	42·4	38·4	41·8	42·6	44·3	36·9	39·1	41·3	39·2	40·5	41	39·2
3	18·5	19·1	19·1	18·8	19·3	..	19	20·2	21·1	17·8	19·9	19·7	18·4	19·2	19·9	20·8	..	17·8	20·4	..	19·4	19·4	17·5
4	5·9	6·1	6·1	6	6·4	6·1	6·1	6	6·1	5·6	5·6	5·9	6	6·2	5·9	6·3	5·5	5·8	6·3	6	5·6	6	5·6
5	16·2	16	16·4	16·1	16·1	16·7	16·3	16·1	16·3	16·1	16·1	15·9	15·2	16·2	16	16·2	14·7	15·6	16·7	14·8	16·2	16·2	15
6	14·6	13·7	14·6	14·1	14·3	13·9	14·3	14·6	14	14·6	14	14·3	13·3	14·6	14·1	15	13·2	14·1	14·3	13·4	14·7	14·3	13·9
7	12·9	12·2	12·8	12·3	12·2	12·3	12·6	13·6	13	12·6	12·1	13·6	12·3	13·1	12·3	12·9	11·5	13·3	13·2	11·3	12·3	12·3	11·8
8	15·6	15·3	16·1	16	15·6	16·2	15·5	16·3	15·8	15·9	16	16·3	15·2	16	16·1	16·8	13·9	15·1	15·9	14·2	16	15·4	14
9	9·4	9·3	9·3	9·2	9·3	9·7	9·3	9·9	9·9	9·5	9·6	9·2	9·2	9·8	9·2	10·1	8·2	9·3	9·6	8·6	9·5	9·4	8·5
10	17·2	17·5	17·6	18	17·7	18·2	17·1	19·6	18·7	17·6	18·6	18·9	16·8	18·5	18·2	19·1	15·8	17·8	18·3	17·3	18·2	18·2	16·9
11	10·8	10·4	10·4	11	10·6	10·6	10	11·3	11	10·5	10·7	11·4	10·2	10·8	10·8	10·9	9·6	10·2	10·4	10·1	10·4	10·4	10
12	14·6	13·9	14·9	15·1	14·3	14·9	14·6	15·5	15·6	13·6	14·6	15·6	14·1	14·6	15·7	16·1	12·5	13·6	15·1	13·9	14·7	15·2	13·7
13	3·9	4·1	4·1	3·7	4·2	4·2	3·9	4·2	4	3·5	3·8	4·4	3·8	4·2	4·4	4·7	3·5	3·5	3·9	3·6	3·8	4·4	3·8
14	20·8	20·7	20·9	21·1	21·4	21·9	21·3	23·4	23	20·5	21·6	22·2	20·6	22·5	22·7	23·6	19·1	20·2	21·9	..	21·3	21·7	20·3
15	10·1	10	9·8	10·2	10·5	10·5	10·6	11·6	11·4	10	10·6	11·3	10	10·9	11·4	11·1	8·8	9·6	10·7	10·1	10·8	10·4	10·1
16	7·5	7·7	7·3	7·5	7·6	8	7·4	8·1	7·8	7·1	7·5	7·4	7·5	7·7	7·4	7·6	6·7	7	7·2	7·2	7·4	7·5	7·6
17	2·5	2·3	2·4	2·4	2·7	2·3	2·4	2·8	3	2·3	2·5	2·8	2·7	2·7	2·8	2·8	2·2	2·3	2·8	2·4	2·5	2·5	2·4
18	6·8	6·8	7·1	7·3	6·9	7	6·9	7·7	7·7	6·5	6·2	7·1	6·7	7·2	7·8	7·6	6·3	6·6	7·1	6·8	7·1	6·8	6·8
19	3·8	4	4	4·4	4·1	4·2	4	4·3	4·2	3·8	3·6	3·2	3·7	3·9	4	4·1	3·6	3·8	4·1	3·8	3·7	3·8	3·4
20	6·6	6·1	6·6	6·3	6·1	6·5	6·3	6·3	6·9	6·2	6·4	6·2	5·7	6·1	6·6	6·3	6·2	6·2	6·4	5·8	5·8	6·3	6·2

(*To be continued.*)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XX.

By Oldfield Thomas, F.R.S.

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A.—NOTES ON THE GENUS *CHELIONES.*

When writing on the members of the large genus *Meriones* (A. M. N. H. (9) III. p. 263, 1919), I came to the conclusion that the Indian species of recent years known as *Meriones hurrianæ*, the Desert Gerbil, is so distinct from all of them that it deserved generic separation, and I founded for it the genus *Cheliones.*

Its chief characters are that the animal is of a more burrowing habit than ordinary *Meriones*, and in correlation with this, the ears are quite short, the fore-claws elongated, and the skull strongly built, much bowed, and with comparatively small bullæ. In *Meriones* the fore-claws are decidedly shorter than the hind, the ears are long, the skull lightly built, and the bullæ very large —all characters of surface-living, desert animals.

The range of the genus extends from the North-West frontier and Baluchistan, just penetrating Afghanistan, on the west, through the great Indian Desert of Rajputana to Delhi, on the east, and Kathiawar on the south.

Throughout the greater, and lowland, part of this area the species, though variable, shows no local specialization, but when the higher grounds of the North-West Frontier and Baluchistan are reached we get a certain difference which may be suitably recognized by the formation of a special sub-species.

Cheliones hurrianæ collinus, subsp. n.

Size apparently slightly greater than in true *hurrianæ*, but owing to the scarcity of specimens in which the basilar suture has closed, it is difficult to make certain of the degree of difference. Colour above on the average darker and grayer, while below the whole under surface, apart from the white chin, is broadly and prominently washed with strong buffy, the bases of the hairs being dark slaty, the total ventral colour resulting being conspicuously darker than in *hurrianæ*, in which the hairs are usually washed with white or pale buffy, and their bases are either wholly white or at most pale slaty.

Skull slightly larger and the palatal foramina longer and more widely open than is usual in *hurrianæ*, though there is much variation in this respect.

Dimensions of the type:—Head and body, 150 mm.; tail, 150; hindfoot, 32·5; ear, 11. Skull, median length, 36·7; diagonal length, to back of bullæ, 37·2; condylo-basal length, 33·5; zygomatic breadth, 21·3; interorbital breadth, 6·8; bi-meatal breadth, 19·5; palatal foramina, 6·1; diagonal length of bullæ, 13; back of bullæ to front of meatal swelling, 8·8; upper molar series, 5·5.

An old male skull with closed basal suture has a median length of 38·5.

Habit:—Hilly region to the north-west and west of the Indian Desert. Type from Kohat, North-West Frontier, 1,000-1,700'. Other specimens from Attock, Khelat-i-Ghilzai, Afghanistan, and Baluchistan, (Wad and Dasht in the far south-west).

Type:—Young adult Female (basilar suture not closed). B. M. No. 7. 6. 8. 7. Original number 31. Collected 23rd February 1907. and presented by Capt. C. H. T. Whitehead.

B.—CHANGE OF COAT IN THE COMMON PALM SQUIRREL—AN APPEAL.

By R. C. Wroughton, F.Z.S.

In connection with the identification of two series of the three-striped jungle squirrel, obtained by Capt. P. Gosse, R.A.M.C., I have again examined all the available material of the (southern) three-striped Palm-Squirrel, as distinguished from the (northern) five-striped Banyan-Squirrel. Unfortunately though the total number of specimens is considerable, it is composed of series representing only one season of the year for each locality.

These squirrels may be divided into three groups, *viz*:—(1) the squirrels (*palmarum*) living commensal with man; (2) those species living wild in the jungle in localities of comparatively heavy rainfall (*tristriatus*, *wroughtoni*, *numarius*); and finally (3) those living in the more arid country of the Dekhan (*robertsoni*).

In all these forms there appears to be a seasonal change of coat, very much marked in *tristriatus*, &c., less so in *palmarum*, and little more than indicated in *robertsoni*.

In *tristriatus* the new coat of the year is assumed about December-January, by the shedding of the old coat and its complete renewal, *i.e.*, by a "moult." In this coat the general ground colour (some shade of "grizzle") extends over the whole upper surface of the body; broken only by the darker saddle-mark, never more than brown in colour, which in its turn carries the three longitudinal buffy stripes.

With the end of February or the beginning of March the first indication of modification of the coat begin to appear, usually, but by no means always, commencing by the formation of black patches, in the saddle mark, upon the shoulders, which spread backwards, until, some time between July and November, the whole of the back is black with white stripes, while, as a secondary detail, the face, in front of the ears, takes on a golden red colour. This face colour seems to be all that remains of the "seasonal" (I use the term without prejudice) change in *robertsoni*, while *palmarum*, though showing some signs of the black coat never dons it in its entirety, at least I have never seen an example.

I believe it may be accepted that the new coat put on at the beginning of the year is the result of a true moult, but how the later changes are brought about, whether all individuals undergo them, to what extent they are effected, if at all, by climate and environment we have not sufficient material to justify even a guess.

I would appeal to members to arrange with the Society to send in for examination series (three or four or more pairs) of their local squirrel in each month round the year. Such series will be most valuable if consisting not only of the forms living in the jungle far from human habitations, but equally of the forms frequenting the bungalow verandah, in City or Cantonments; the only proviso being that all specimens of any series are obtained as near as possible from the same spot, and of course all specimens must be dated without which their value is lost.

C.—TWO NEW FORMS OF THE "*FUNAMBULUS TRISTRIATUS*" GROUP.

By R. C. Wroughton and Winifred M. Davidson.

In a collection of mammals made by Captain P. Gosse, partly in the Nilgiris and partly at Khandalla, are included two series of *Funambulus*, one from each locality. These two series differ not only between themselves but also from any named form in the Museum Collection.

Mr. H. C. Robinson has recently described (Records Ind. Mus. xiii, 1, p. 41, 1917) a new form of *tristriatus* under the name *annandalei*. In default of authenticated specimens of true *tristriatus* Mr. Robinson adopted specimens from Kanara, for comparison, as representing *tristriatus*, not knowing (l. c. footnote) that these Kanara specimens had been allotted to a new form, *numarius*. The British Museum has a series, sent by Capt. H. Ferguson, from Trevandrum, which are undoubted *tristriatus*, with the type of which they agree in all essential particulars. We find it therefore difficult to believe that there is another form in Travancore without evidence of much greater divergence than is shown in the description of *annandalei*.

The description of these two new forms will render necessary considerable alterations if not the complete remodelling, of the Key to the Genus in Wroughton's Summary later on. Here we would merely point out that for the present the sleek coat of the *palmarum* group as compared with the rougher, more ragged-looking, fur of the jungle dwellers is a better guide to diagnosis than size of the respective skulls.

The following are descriptions of the two new forms:—

FUNAMBULUS THOMASI, sp. nov.

A Funambulus of the *tristriatus* group, slightly smaller than F. *tristriatus* and *numarius*, and considerably smaller than *F. wroughtoni*.

Fur about 8 mm. long, fine but not so silky as in *tristriatus*, the coat having a rougher appearance. General colour of body apart from the dorsal area grey grizzled with ochraceous, less warm in tone than in *numarius*; saddle patch, approaching "chestnut brown," showing evidences, in two specimens, of the presumably seasonal change to black; three longitudinal dorsal stripes, white or cream, the central continued farther forward than in *tristriatus*, more as in *numarius*. Under surface buffy white. Face mixed golden and ferruginous. Tarsus faintly buffy. General tint of hind-feet a colder grey than the ground colour of the body; fine fringe of hairs edging the soles greyish or silvery white, not buffy or ochraceous, as in *tristriatus* and *numarius*. Tail less bushy than in *tristriatus*, as in *numarius*, and relatively shorter than in either species; above, darkly grizzled; below, with the characteristic orange midrib.

Skull of about the same size as in *numarius*, but rather broader and lower; braincase less arched. Upper tooth-row consistently shorter, and breadth of palate conspicuously less, than in *numarius*.

Dimensions of type (as recorded by the Collector):—

Head and body, 147; tail, 130; hind-foot, 35; ears, 15.

Skull: greatest length, 41; condylo-incisive length, 37·6; zygomatic breadth, 24·2; length of nasals, 13; breadth of braincase above meatus, 17; interorbital breadth, 13; palatilar length, 18·1; breadth of palate between molars, 5·2; diastema, 9·5; length of bullæ on an antero-posterior line, 7·8; upper tooth-row, 7·2.

Hab. Khandalla, Bombay Presidency. Alt. 2,000 feet.

Type. Adult female. B.M. No. 19. 6. 3. 50. Original No. 107. Collected 11th April 1918, and presented to the National Museum by Captain Philip Gosse, R.A.M.C.

Captain Gosse collected five specimens, two males and three females, in addition to which we have examined two specimens from Thana, in the National Collection, unfortunately without date, which seem to be referable to this species. Of the five Khandalla specimens, collected between February and April, two April specimens are already beginning to assume the dark "summer" colouring; while the two additional specimens from Thana are in full "summer" coat, with black saddle-patch and deep ferruginous colouring on the face.

We have pleasure in naming the species after Mr. Oldfield Thomas.

FUNAMBULUS GOSSEI, sp. nov.

A Funambulus of the *tristriatus* group, markedly smaller than *F. tristriatus* and *numarius*, and slightly smaller than *F. thomasi.*

Fur 5—6 mm. long, as fine and silky as in *tristriatus*. General colour of body, apart from the dorsal area, freely sprinkled with buffy, the resulting appearance grizzle drab, lighter than in *thomasi* and noticeably lighter than in *tristriatus* and *numarius*. Saddle patch in very dark "summer" colouring centrally, rich "chestnut brown" tending to deep burnt umber on its borders. Three longitudinal dorsal stripes, white or cream, continued but only faintly visible on the nape, the central one very slightly narrower. Undersurface buffy white. Face reddish, but not so brightly coloured as in *tristriatus*, *numarius* and *wroughtoni*. Thighs, above coloured like the body; below, white. Tarsus occasionally with faint buffy tinge. General tint of hind-feet somewhat paler than ground colour of body; fine fringe of hairs edging the soles greyish or silvery white, as in *thomasi*, not buffy or ochraceous as in *tristriatus* and *numarius*. Tail above, buffy, with whitish edges, darkly grizzled and tipped, the darkest grizzling appearing so regularly as to give a suggestion of faint rings; below, with orange midrib less vivid than in *numarius* and *wroughtoni*, more as in *tristriatus* and *thomasi*.

Skull conspicuously smaller than in *tristriatus*, but of similar, though perhaps rather slenderer, build. Incisors vertical or very slightly opisthodont, not proodont as in *tristriatus*. Upper toothrow proportionately longer than in *numarius*.

Dimensions of type (as recorded by the Collector):—

Head and body, 138; tail, 147; hind-foot, 36; ear, 16.

Skull: greatest length, 38; condylo-incisive length, 35; zygomatic breadth, 21·5; length of nasals diagonally, 11·2; breadth of braincase above meatus, 17; interorbital breadth, 12; palatilar length, 16·5; breadth of palate between molars, 4·7; diastema, 8·5; length of bullæ on an antero-posterior line, 7·1; upper toothrow, 7·9.

Hab. Kotagiri, Nilgiri Hills. Alt. 4,100—4,500 feet.

Type. Adult male. B.M. No. 19. 6. 2. 30. Original No. 201. Collected 20th June 1918, and presented to the National Museum by Captain Philip Gosse, R.A.M.C.

Eight specimens were collected by Captain Gosse, four males (two immature), three females, and one of unrecorded sex immature. The species is readily distinguishable by its small size. All specimens are in the "summer" phase, including two of the immature examples which are less than half grown.

We have named the species in honour of Captain Gosse, in token of his interest in mammalogy, which has resulted in the determining of the two new forms here described.

D.—ON THE GENUS *TADARIDA* (WRINKLE-LIP BATS).

BY

R. C. WROUGHTON, F.Z.S.

Blanford places the two species *tragatus* (No. 224), and *plicatus* (No. 225) in the Genus *Nyctinomus*. Dobson in 1874 (J. A. S. B. Vol. XLIII, pt. 2, p. 142) established 3 subgenera *Dinops*, *Dysopes*, and *Chaerephon*, placing both the above mentioned species in *Dysopes*. That name however having already been used for a different animal had to be dropped. Later *Chaerephon* was recognised as a full Genus and *plicatus* was assigned to it, *tragatus* being retained in *Nyctinomus*. Lyon (Proc. Biol. Soc. Wash. xxvii, p. 217, 1914) pointed out that *Tadarida* antedated *Nyctinomus*. The species *tragatus* must therefore now be recognized as belonging to that Genus, of which it is the only Indian representative. Dobson described *tragatus* (1. c. supra) chiefly by distinguishing it from *plicatus*, though he noted its resemblance to *cestonii*. In 1876, in his Catalogue of the Asiatic Chiroptera (p. 181) he repeated his description, but added a few body measurements which do not help very much towards identification. Still later, in 1878, (Catalogue of the Chiroptera of the British Museum, p. 424) he compared it with *ægyptiacus*, Geoff. pointing out that it had 6 incisors in the lower jaw whereas *ægyptiacus* had only 4. There appear to be therefore two sections in the Genus *Tadarida*, *viz.*, one represented by *ægyptiacus* with 4 incisors in the lower jaw, and, though this character is not noted by Dobson, the anterior premolar reduced to a mere rudiment; the other section represented by *tæniotis* (=*cestonii*) with 6 incisors in the lower jaw, and an anterior premolar which though markedly reduced in size, is still a functioning tooth.

Dobson's *tragatus* therefore belongs to this latter, or *tæniotis*, section, which is represented in the National Collection (so far as the Indian fauna is concerned) by a single specimen from Malabar. There are, however, three other specimens belonging to the *ægyptiacus* section, as do all the specimens obtained by the Mammal Survey, *viz*:—Sind, 3; Cutch and Kathiawar, 14; Dharwar and Mysore, 3; and Dekhan, 6. These have all been entered in the Reports as *Nyctinomus tragatus* which clearly is a mistake, and they almost certainly are a form, or forms, identical with, or closely related to *Tadarida ægyptiaca*.

Having laid out and studied all the available material I have decided to describe as new three forms which may be compared as follows:—

A.—Size larger, forearm about 52 mm.

a. General colour paler, about "drab grey." ... ... *ægyptiaca*, Geoff.

b. General colour darker, about "mouse grey." ... ... *sindica*, sp. n.
B.—Size larger, forearm 48 or less.
a. General colour paler, near "seal brown." ... ... *thomasi*, sp. n.
b. General colour darker, near "clove brown." ... ... *gossei*, sp. n.

The following are descriptions of the three new species :—

TADARIDA SINDICA, sp. n.

A *tadarida* of about the same size as *ægyptiaca*, coloured in the same way but markedly darker in colour.

Size and fur as in *ægyptiaca.*

General colour above about "mouse-grey," as compared with "drab-grey" in *ægyptiaca.* Showing the same pattern below as that spacies, *viz.*, a darker band coming round over the shoulders and turning backwards along the flanks, close to the base of the wings, the centre of the abdomen quite markedly paler, the general darker colouring, as compared with *ægyptiaca* well maintained, but a white region on the flanks immediately at the bases of the wings, which is not present in the other species.

Skull broader and stouter than in *ægyptiaca*, the anterior premolar even more rudimentary.

Dimensions of type :—Head and body, 77 ; tail, 60 ; forearm, 52 ; ear, 23. Skull :—Condylo-incisive length, 19·9 (20·3) ; Zygomatic breadth, 13 (12·6) ; braincase breadth, 10·9 (10·3) ; least interorbital breadth, 4·9 (4·6) ; breadth across muzzle at lachrymal processes, 7·9 (7·6) ; palatal breadth across posterior molars 8·8 (8·7) ; toothrow behind anterior premolar, 5·8 (6).

Hab :—Sind. Type from Kashmir, Upper Sind Frontier.

Type :—Adult. O. B. M. No. 15, 11, 1, 51. Original number 519. Collected 6th March 1915, by Mr. S. H. Prater and presented to the National Collection by the Bombay Natural History Society.

Three specimens in all were taken by Mr. Prater. The contrast in colouration is very marked and that in the shape of the skull much more so than seems indicated by the measurements recorded.

TADARIDA THOMASI, sp. n.

A *tadarida* considerably smaller than either of the preceding, with much warmer colouration.

Size noticeably smaller than either *ægyptiaca* or *sindica.*

General colour above near "seal brown," below only slightly paler.

Skull much as in *sindica*, but smaller in all dimensions.

Dimensions of the type :—Head and body, 76 ; tail, 36 ; forearm, 47 ; ear, 20. Skull :—Condylo-incisive length, 18·7 ; Zygomatic breadth, 11·7; braincase breadth, 9·7; least interorbital breadth, 4·5; breadth across muzzle at lachrymal processes, 6·9; palatal breadth across posterior molars, 8; toothrow behind anterior premolar, 5·4.

Hab:—Cutch and Kathiawar. Tpye from Bhuj, Cutch.

Type:—Adult. O. B. M. No. 12, 10, 4, 32. Original number 537. Collected 25th September 1911, by Mr. C. Crump, and presented to the National Collection by the Bombay Natural History Society.

Mr. Crump obtained 4 specimens at Vankaneer, 2 at Mt. Abu, and 8 in Cutch.

I have much pleasure in naming this very distinct species in honour of Mr. Oldfield Thomas to whom the Mammal Survey, especially on its scientific side, owes so great a debt.

TADARIDA GOSSEI, sp. n.

A *tadarida* closely resembling *thomasi* except in colouration, which is much darker.

Size, on the average, slightly smaller than *thomasi*.

General colour above darker than in *thomasi*, near "clove brown," below only slightly paler in the centre of the abdomen.

Skull scarcely differing from that of *thomasi*.

Dimensions of type:—Head and body, 65; tail, 36; forearm, 46; ear, 20. Skull:—Condylo-incisive length, 18·5; Zygomatic breadth, 11·8; braincase breadth, 10; least interorbital breadth, 4·5; breadth across muzzle at lachrymal processes, 6·9; palatal breadth across posterior molars, 8·1; toothrow behind anterior premolar, 5·2.

Hab:—Poona. Type from Sassoon Hospital.

Type:—Adult. O. B. M. No. 19, 6, 3, 21. Original number 87. Collected 19th March, 1918, and presented to the National Collection by Capt. P. Gosse, R.A.M.C.

Capt. Gosse obtained altogether 6 specimens.

INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S.

(With Text-figures)

(Continued from page 517 of Volume XXVI)

Part V.

Genus—INDOTHEMIS.

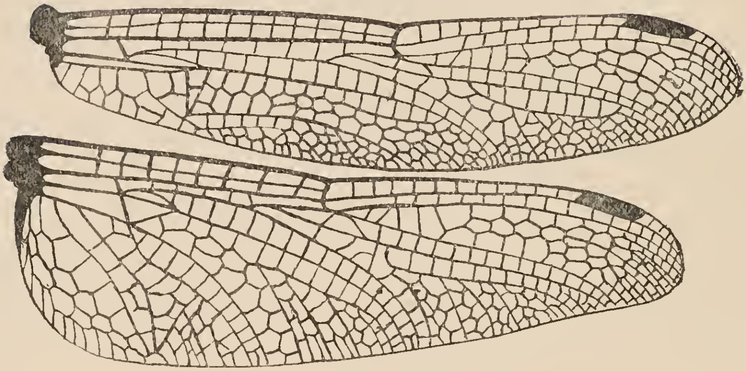

Fig. 43.—Wings of *Indothemis limbata* showing neuration.

Head moderately large ; eyes moderately contiguous ; frons with a sharp foreborder and shallow suture ; vesicle high.

Prothorax ; posterior lobe small and procumbent.

Thorax fairly robust ; hind femora in the male with about 12 moderately slim, gradually lengthening spines ; tibial spines numerous, fine and moderately long ; claw-hooks slim and inclined.

Wings long, reticulation rather close ; trigone in the forewing about one cell distal to the line of the trigone in the hind ; sectors of the arc in forewing shortly fused, a longer fusion in the hind ; arc between the 1st and 2nd antenodal nervures ; 8th nervure in the hindwing widely separated from the anal angle of trigone ; antenodal nervures 8½ to 12½, the final incomplete ; trigone in the hindwing at the arc ; 1 cubital nervure to all wings ; no supplementary nervures to the bridge ; trigone in the forewing traversed; sub-trigone with 3 cells ; trigone in the hindwing and all hypertrigones free ; 4th nervure flatly curved in the middle ; 1 row of cells between 5 and 5a ; 8th nervure in the forewing strongly arched ; discoidal field with 3 or occasionally 2 cells at the beginning and then for a short length, 2 cell rows, strongly dilated at the termen; anal field of hindwing broad; loop with a broad apex, traversed cells at the outer angle. Membrane and stigma of medium size.

Sexual organs. For male, see under species.

Female with a small, projecting vulvar scale; border of 8th segment not dilated.

Key to Species.

1. 8½ antenodal nervures to the forewing; apices of wings hyaline........................ *I. cæsia.*
2. 12½ antenodal nervures to the forewing; all apices tipped broadly with dark brown; hindwing with a large, dark brown, basal spot.................................. *I. limbata.*

51. Indothemis cæsia, Ris, 1911.

Libellula cæsia, Rambur, 1842.
Trithemis cæsia, Brauer.
Diplax meridionalis, Selys.

Male: Expanse 65 mm. Length 40 mm. Abdomen 17 mm. Hindwing 32 mm.

Head globular; eyes broadly contiguous for a distance equal to the breadth of the occiput, dark reddish brown with a purple sheen above and a dark lilac grey at the sides and beneath; occiput black; vesicle metallic blue, frons metallic blue; epistome black with yellow sides; labrum black; labium brownish.

Prothorax lobe small, recumbent, rounded and fringed with a few long ciliæ, black.

Thorax long and narrow, bluish black above and at the sides, marked obscurely with black as follows:—the mid-dorsum broadly, a humeral stripe with irregular borders and the lateral sutures. The bluish black changes to a greenish yellow on the metepimeron, the latter colour extending on to the under surface.

Wings hyaline; antenodals 8½ to 9½; discoidal field very variable, even in the wings of individual species, commencing with a row of 3 cells, then 2 or more rows of 2 cells, or commencing with 2 rows of 3 cells and then 2 rows of 2 cells. Stigma dark brown.

Legs black, the bases of femora a pale yellow. The hind femora with scanty, widely set, short spines and one longer one at the distal end; mid femora with a row of gradually lengthening spines. Tibial spines long and numerous.

Abdomen laterally parallel, dorso-ventrally dilated at the base, depressed in the middle part and then at the anal end again slightly dorso-ventrally dilated. Bluish black marked with large, wedge-shaped, lemon yellow spots on all segments except 9 and 10. These spots have their base at the proximal end of the segments and gradually decrease in size as traced towards the anal end of abdomen. Beneath, a similar set of spots, except on the 9th and 10 segments.

Anal appendages creamy white with black tips.

Sexual organs: lamina procumbent, almost invisible in profile; tentaculæ with a foliate, external branch, internal branch hooked; lobe small, rounded.

Female: expanse 63 mm. Length 37 mm. Abdomen 15½ mm. Hindwing 29 mm.

Head: eyes very pale violety brown above, laterally very pale olivaceous fading to a pale grey or a bottle green beneath; occiput pale olivaceous; vesicle olivaceous; frons and epistome a greenish yellow with a faint touch of ochreous above; labrum pale yellow; labium a dirty yellow, bordered with black.

Prothorax small, fringed with a few ciliæ.

Thorax moderately large, greenish yellow with black markings as follows:—the dorsal carina black with a diffuse, golden brown stripe on either side, a humeral stripe, all the lateral sutures and spiracle outlined in black.

Legs yellow, striped with black. Armature the same as in the male.

Wings hyaline, antenodal nervures 8½, discoidal field commencing with 1 or 2 rows of 3 cells and then 1 or 2 rows of 2 cells or else entirely made up of rows of 3 cells. Subject to less variation than in the male, the latter formation prevailing. Stigma pale brown outlined with black.

Abdomen with parallel sides, dorsum strongly carinated, base very slightly dilated, tapering a little at the anal end. Bright yellow marked with black as follows:—a fine, middorsal line on the carina, and a lateral, forked spot on each segment, with its base at the distal end. Intersegmental nodes finely black.

Anal appendages yellow tipped with black.

Vulvar scale projecting.

Hab. Continental India in the plains, Bombay, Madras, Jubbulpore.

52. **Indothemis limbata**, Ris.

Trithemis limbata, Selys.

Male: Expanse 58 mm. Length 32 mm.

Head globular; eyes reddish brown above, lilaceous below and at the sides; epistome and the lower part of forehead reddish brown, above black; vesicle black and the forehead immediately in front of it, greenish yellow; occiput black.

Prothorax black, the posterior lobe small, depressed, arched.

Thorax violety black, in some adult specimens a whitish violet powderng at the sides. Legs black.

Wings hyaline, the retriculation black. Stigma dark brown, framed in black; apices of wings narrowly tipped with dark brown; a basal marking in the hindwing of dark golden brown, extending nearly up to the 1st antenodal nervure, a little beyond the cubital nervure and thence in a strong curve to the anal angle. In the forewing a similar coloured spur in the subcostal, cubital spaces and anal angle. Membrane black.

Abdomen slightly depressed, the sides nearly parallel, tapering gradually to the end. A glossy black, with traces of pruinescence in very adult specimens.

Anal appendages narrow, pointed, black.

Sexual organs: lamina moderately long, at first depressed, then projecting somewhat, shallowly notched, its free border furnished with golden brown hairs; tentaculæ very small, the internal, a projecting, recurved hook; the external, a depressed, triangular, broad, foliate organ; lobe small, broadly rounded, nearly as high as the tentaculæ.

Female unknown.

Hab. Burma.

Genus—BRACHYTHEMIS.

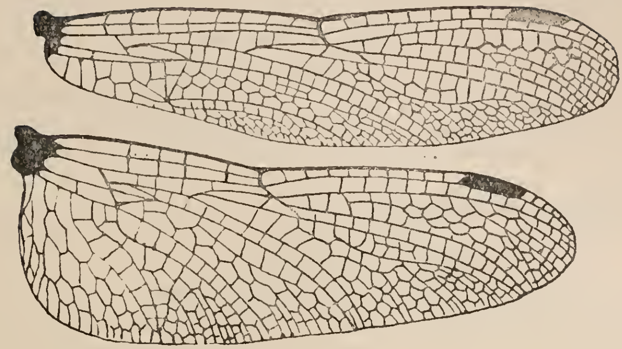

Fig. 44.—Wings of *Brachythemis contaminata* showing neuration.

Brachythemis, Brauer, 1868.

Head moderately large ; eyes moderately contiguous ; forehead strongly rounded and with no marked foreborder ; suture flush ; vesicle high and narrow, with two small points on summit.

Prothorax ; lobe very small, broadly arched.

Thorax moderately robust. Legs long, hind femora with a row of gradually lengthening spines, mid femora with similar, stouter, smaller spines. Tibial spines numerous, fine and moderately long. Claw-hooks medium.

Abdomen narrow and short, slightly fusiform, depressed and gradually tapering toward the end. A transverse ridge on the 4th segment.

Wings short and moderately narrow, the reticulation close, those of the male usually crossed by a coloured fascia ; trigones in line with each other ; sectors of arc shortly fused ; arc between the 1st and 2nd antenodal nervures, 8th nervure in the hindwing either at the anal angle of the trigone or a little separated ; $6\frac{1}{2}$ to $8\frac{1}{2}$ antenodal nervures, the final incomplete ; trigone in hindwing at the arc or slightly proximal ; 4th nervure with a single flat curve ; 1 to 2 rows between 5 and 5a ; trigone in the forewing broad, entire or traversed, that of the hind entire ; sub-trigone in the forewing entire or with 2 or 3 cells, when with 2 cells, the traversing nervure strongly convex ; all hypertrigones free ; 1 cubital nervure to all wings ; no supplementary nervures to the bridge ; 8th nervure in the hindwing long, slightly curved ; the discoidal field with parallel sides or but slightly dilated, with 3 rows of cells ; anal field in the hindwing broad ; loop long and broad, its mid-sector nearly straight, the cells between its inner border and the basal margin of wing with a tendency to be arranged in rows. Stigma small. Membrane of medium size.

Sexual organs : male, small ; lamina depressed, its free border prolonged ; the tentaculae, two small hooks and poorly developed external process; the lobe prominent and arched. Female: border of 8th segment not dilated; at the end of the 8th ventral plate, a moderately long, split vulvar scale; the 9th ventral plate a tongue-like process overlapping the 10th segment.

KEY TO SPECIES.

1.	Wings of male a dark, blackish brown from base to node	*B. fuscopalliata.*
2.	Wings of male a rich amber tint as far as the stigma	*B. contaminata.*

53. **Brachythemis fuscopalliata,** Ris.

Trithemis fuscopalliata, Selys.
Cacergates fuscopalliata, Kirby.

Male: Expanse 58 mm. Length 38 mm.

Head moderately large; eyes dark brown above, sepia tint beneath; occiput vesicle and upper part of epistome dark brown; lower part of epistome with a transverse, black streak; labrum and labium yellow.

Prothorax black, the lobe small and arched.

Thorax robust, an uniform black, with a patch of ferruginous at the attachment of each wing on the sides. Legs black, the outer surfaces of of the tibiæ striped with yellow.

Wings: antenodal nervures $6\frac{1}{2}$ to $7\frac{1}{2}$; subtrigone of the forewing entire or traversed by a strongly convex nervure; 1 row of cells between 5 and *5a,* some of these occasionally divided; stigma bright opaque yellow; costa brown or reddish brown outwardly; a broad, blackish brown fascia crossing both wings from the base as far out as the 2nd postnodal nervure in the forewing and the 3rd or 4th in the hind, in the hindwing this fascia sloping to meet the termen at about its middle.

Abdomen short and tapering, uniformly black.

Anal appendages bright ochreous.

Sexual organs: lamina recumbent, two tufts of long, greyish hairs on its surface; tentaculæ very small, the internal, slim, strongly curved hooks, the external low and blunt; lobe moderately large, arched and higher than the tentaculæ. (See Jour., Bombay Nat. Hist. Soc., Sep. 15 1917.)

Female: Head; eyes olivaceous, with 2 dark, equatorial lines traversing them from above down; the remaining parts a light, greenish-yellow.

Prothorax lemon-yellow with 2 transverse, black streaks.

Thorax olivaceous green marked with a 3-lined fascia in the humeral region and the spiracle and sutures laterally outlined in black.

Legs yellow, streaked in their length with black.

Wings: antenodal nervures $8\frac{1}{2}$ to $7\frac{1}{2}$, the final complete or incomplete, this asymmetry sometimes seen in the opposite wings of a single specimen. Trigone in forewing free or traversed once. The antenodal nervures and stigma, a bright yellow; the black fascia of the male not present, the wings being entirely hyaline.

Abdomen olivaceous green with a brown, subdorsal fascia and the mid-dorsal carina finely black; edges of abdomen narrowly black. The extent of the black markings is subject to much variation according to the age of specimens.

Expanse 62 mm. Length 35 mm. (See J. B. N. H. Soc., Sept. 15, 1917.)

Hab. Lower Mesopotamia. I have not taken this insect further up the Shat-el-arab than Kerna, it is common about Basra. The specimens described by Ris are from Fao. It has much the same habits as the following insect *contaminata* and keeps to the banks of rivers.

54. Brachythemis contaminata, Brauer.

Libellula contaminata, Fabr.
Libellula truncatula, Rambur, 1842.

Male : Exp. 45 mm. Length 32 mm.

Head : eyes violety brown above, puce, olivaceous or olive green at the sides and beneath; occiput brown ; frons and epistome a very pale green, almost white or in very adult specimens, olivaceous.

Prothorax ochreous with 2 transverse brown stripes.

Thorax olivaceous brown, darker on the dorsum ; an obscure, brown, humeral fascia and 2 similar lateral fasciæ on the sides ; the sutures black.

Legs ochreous, the femora black externally.

Wings hyaline, the reticulation reddish ; a rich, amber-coloured fascia extending from the base outwards to the proximal end of stigma or a little further. This fascia is most intense in its outer part and in some specimens is separated from that part covering the base, usually there is a variable area which is but faintly tinted between the basal and outer parts. It is subject to wide variation being most intense in the wet-season and southern forms. In some it is almost absent. Stigma red. Membrane ochreous. Antenodal nervures 8, some of them running from the intercostal to the costal nervure only and others only between the subcostal and intercostal nervures. Occasional nervures are bifid.

Abdomen rich ochreous or even reddish, marked with obsolete, dorsal and subdorsal stripes. In some specimens the ground colour of the abdomen is a pale greenish yellow, this colour being almost obscured by a broad, subdorsal fascia on each side, which entirely covers the last 4 to 5 segments and expands and meets across the dorsum at the distal parts of many segments. Some specimens in addition show a row of geminate, narrow, black, dorsal streaks and another row of fine black streaks on the outer side of the subdorsal, ochreous fascia.

Anal appendages ferruginous.

Female paler but the markings much better defined, especially on the abdomen. Eyes a paler brown colour above. Face pale or whitish.

Thorax a pale greenish yellow, the fascia noticed in the male being darker and better defined, the humeral one forking below. Sutures of the thorax and those of the first few segments of the abdomen, mapped out in black.

Wings hyaline, with no amber tinted fascia as in the male. Stigma conspicuously bright yellow.

Anal appendages paler, black tipped.

Hab. Continental India. Ceylon, Malay Peninsular, Indo-China.

This species is invariably found along the banks of rivers or large tanks. Males and females are about equal in numbers and during the daytime do not appear to molest one another, paring taking place at dusk. The insect is on the wing from earliest dawn to dusk and its shadowy form may even be noted hovering over water long after dark, during which hours, its principal food consists of mosquitoes.

Genus—ZYGONYX, SELYS.

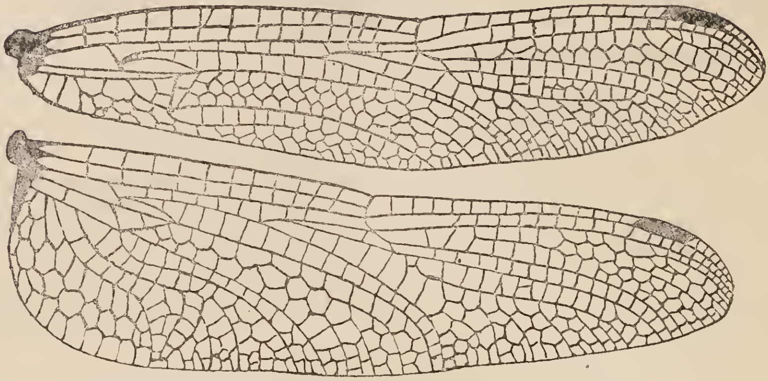

Fig. 45. Wings of *Zygonyx iris* showing neuration.

Zygonyx, Selys, 1867, 1871, Brauer, 1868, Karsch, 1890, Kirby, 1900.
Zygonidia, Kirby, 1900 and 1901.
Neurocena, Kirby, Ann. Mag. Nat. Hist., 1900, Id. 1905.

Head large and globular; eyes moderately contiguous; forehead prominent, rounded; vesicle high and broad, notched at its summit.

Prothorax: lobe small, flatly arched, not projecting.

Thorax robust. Legs long and slim; hind femora with a row of stout, small, triangular spines and 3 or 4 longer ones at the distal end: mid-femora furnished with a dense mass of long coarse hairs. The hind femora of female with a row of gradually lengthening spines. Tibial spines very long and numerous. Claw hooks very robust, more so than the claws, which are exceptionally long.

Abdomen robust, the base somewhat dilated, the 3rd and 4th segments distinctly constricted, especially in the male and then parallel-sided as far as the end. Abdomen of female more robust than that of male and the sides of the 9th segment dilated.

Wings long and narrow, very robust, the node of forewing being placed far distal to the middle point of wing; reticulation rather open; trigone of forewing about 2 cells distal to the line of the trigone in the hind; sectors of arc fused for a short distance in the forewing; for a longer distance in the hind: arc usually between the 1st and 2nd antenodal nervures; 8th nervure in the hindwing at the anal angle of the trigone or a little separated: antenodal nervures very variable, 12½ to 16, the end one complete or incomplete; base of trigone in the hindwing usually a little proximal to the arc; 1, 2 or 3 cubital nervures in the forewing, 1 or 2 in the hind; no supplementary nervures to the bridge (I possess one specimen which has an accessory nervure in one of the forewings); relation of trigone in the forewing to the hypertrigone rather more than a right angle, usually traversed but in one species free: trigone in the hindwing traversed or entire; subtrigone in the forewing with 1 to 4 cells; 4th nervure variable, with a single flat curve or markedly undulated; 1 or 2 rows of cells between 5 and *5a*, or a few divided cells; the discoidal field usually with 3 rows of cells, dilated at the termen; anal field broad, the loop very long and its apex bent sharply at a right angle to the stem, the mid-nervure bent at a right angle; 2 or 3 rows of cells between the loop and anal border of wing. Membrane of medium size. Stigma long narrow.

Sexual organs. See under species.

KEY TO SPECIES.

A. Only 1 cubital nervure in the forewings. Trigones in both wings entire. Costal and proximal sides of trigone in the forewing equal .. .. .. *Z. ilia.*

B. 2 or 3 cubital nervures in the forewings. Trigones traversed or entire. Costal side of trigone in the forewing much shorter than the proximal.

a. 2 rows of discoidal cells as far as bridge .. *Z. ida.*

b. 3 rows of discoidal cells at beginning .. *Z. iris.*

Of the above 3 species, only *iris* is taken within Indian limits, the others inhabiting Malaysia and Indo-China.

55. Z. iris, Selys, 1869, Kirby, 1890, Martin, 1904, Ris, 1911.

Zygonidia insignis, Kirby, 1900.
Zygonidia malayana, Laidlaw, 1902.
Zygonidia ceylanica, Kirby, 1905.
Zygonidia ænea, Kirby, 1905.

Male: Expanse 95 mm. Length 55 mm. Abdomen 38 mm. Hindwing 43 mm.

Head: eyes deep sea blue above, paler beneath; vesicle, forehead and upper part of frons a shiny, metallic violet; lower part of frons and epistome bright yellow with an obscure black spot in the middle of latter; labium black with 2 small yellow spots at its base; labrum yellow, its free border narrowly black; occiput black.

Prothorax black marked with a fine, yellow collar anteriorly and a similar one across the middle lobe.

Thorax metallic green or bluey green, marked with yellow as follows:—an irregular, broad, yellow post-humeral fascia, 2 broad, lateral, yellow stripes, one at the spiracle and the other crossing the metepimeron, a row of yellow spots on the tergum. The mid-dorsal carina finely pale.

Legs black, the anterior femora yellow beneath.

Abdomen black, the first 3 segments shiny and sometimes with a metallic lustre, the remainder a matt black. Segments 1 to 3 and the base of the 4th with a large, lateral, yellow spot, the intersegmental nodes as far as the 6th finely ringed with yellow, the dorsal carina finely yellow, expanding on the anterior half of the 7th to form a large, yellow shield-like spot. Anal appendages and the last 3 segments black, the former being long and slim, as long as the 9th segment.

Wings hyaline but faintly tinged with yellow, the apices distinctly smoky. Stigma long, narrow, black. Membrane grey, the wing membrane adjacent to it, narrowly brown. Neuration subject to much variation, even in the wings of any single specimen, asymmetry being the rule rather than the exception.

In one specimen, a male, there are 2 rows of cells between 5 and *5a* in the left forewing, 1 row in the right forewing; in the right hind several cells are divided and in the left, some are forked so as to form triangular cells; antenodal nervures in the left forewing 13½, in the right 15; in another specimen, a female, the left fore and hind-wings have only 1 row of cells between 5 and *5a*, 2 rows in the right forewing and some divided cells only in the left. Antenodal nervures in the right forewing 15½, in the left 16. The trigone in the hindwing is distinctly proximal to the arc.

Sexual organs : lamina depressed at its base, distinctly beaked at its end ; tentaculæ small, the internal a short, black recurved hook, the external sub-quadrate ; lobe broad and short, projecting.

Female very similar to the male, but the markings better defined and broader. A small, mid-dorsal spot of yellow is present on the 6th segment, in addition to the large spot on the dorsum of the 7th. On the side of the 4th segment, there is an obscure yellow line in partial prolongation of the lateral, yellow spot.

Sexual organs : border of the 8th abdominal segment not dilated, but that of the 9th, markedly so. In one specimen which I possess, these dilatations are distinctly seen grasping a mass of ova which the insect was busily engaged in depositing in water at the time I captured it.

Hab. Bengal, the Southern Hills of India, Ceylon, not below 3,000 feet. The insect, in the Nilgiris, may be seen following the course of brooks on the ghat roads, the female, however, keeping to more retired situations such as the beds of precipitous mountain torrents. In Ceylon it is found in similar situations. Eastwards it is found throughout Malaysia and Indo-China.

Genus—ONYCHOTHEMIS, *Brauer.*

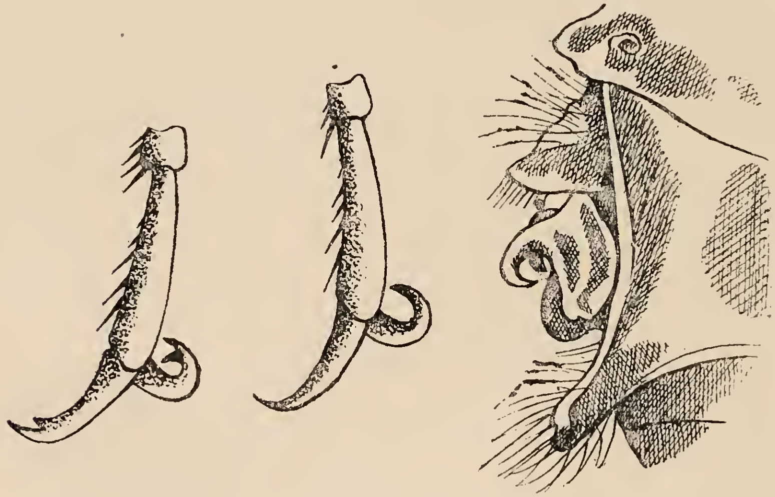

Fig. 46. *a.* Male sexual organs of *Onychothemis tonkinensis ceylanica.*
b. Claws of same contrasted with "c" which shows the claws of *Zygonyx iris* furnished with claw-hooks.

Onychothemis, Brauer, 1868, Kirby, 1890, Karsch, 1890, Kirby, 1905.

Five species have been described, only one of which is found within Indian limits.

Head relatively small ; eyes shortly contiguous ; forehead prominent and rounded, the foreborder not marked ; vesicle conical, high.

Prothorax with a moderately large posterior lobe, projecting somewhat, the border arched and bearing a small notch.

Thorax very robust. Legs long and robust, the armature similar in both sexes; the hind femora with a row of robust, closely-set, gradually lengthening spines, which in the other femora are replaced by a row of fine spines.

Tibiæ with a few widely-set, very stout spines; claws very long and entirely without claw-hooks or if present, only as the merest, tiny projection.

Abdomen robust, the base a little dilated, slightly depressed, but the end segments strongly keeled, tapering from the base to the anal end. No ridge on the 4th segment.

Wings long and broad, the reticulation close; trigone in the forewing in line with that in hind; sectors of the arc with a long fusion; the arc between the 1st and 2nd antenodal nervures; 15½ to 17½ antenodal nervures, the final incomplete; 8th nervure at the anal angle of the trigone; trigone in the hindwing generally a little proximal to the arc; 1 cubital nervure to all wings; no supplementary nervures to the bridge; trigone in the forewing traversed, its costal side short, its relation to the hypertrigone about a right angle; trigone in the hindwing and all hypertrigones free; subtrigone in the forewing 3 or 4 cells; 4th nervure strongly undulated; 2 rows of cells between 5 and *5a.*; 8th nervure in the hindwing moderately convex; the discoidal field strongly dilated at the termen, with 3 cell rows; anal field broad, the loop very long, extending as far as 3 cells distal to the outer angle of the trigone, its toe very narrow, 4 rows of cells between it and the anal border of the wing, these cells not distinctly arranged in rows. Membrane moderately large. Stigma medium.

Sexual organs. See under species.

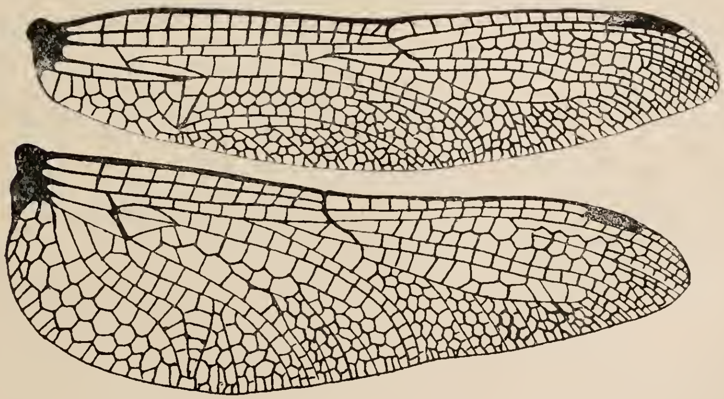

Fig. 47.—Wings of *Onychothemis tonkinensis ceylanica* showing neuration.

56. Onychothemis tonkinensis ceylanica, Ris.

Ris describes this insect as a new sub-species from Ceylon; my own description is made from a female specimen taken in the Nilgiris and, allowing that Ris made his from a dried and faded specimen, the two agree in the main and are doubtless the same species. I am not aware that this insect has been taken in India before.

Male and female very similar.

Head comparatively small; eyes bottle green; occiput black edged behind with canary yellow, entirely yellow at the back; vesicle conical, with 2 points which are tipped with brown, metallic green with a bright yellow summit; frons and forehead above metallic green; epistome and labrum a dirty yellow, the former with 2 diffuse brown spots about its middle; labium a dirty yellow with diffuse brown borders.

Prothorax black with a yellow collar anteriorly and the free border of the posterior lobe yellow, this latter border furnished with a ruff of long, pale coloured hairs which interlace with similar hairs on the back of the head and antero-dorsal surface of the thorax.

Thorax black, deep blue metallic lustre marked with bright yellow as follows:—the mid-dorsal carina and interalar sinus yellow, a post-humeral, incomplete fascia consisting of 2 spots just joined by a narrow isthmus, 2 moderately broad fasciæ on the sides, the posterior one crossing the metepimeron and finally a row of yellow spots on the tergum.

Legs black, armature as described for the genus, no claw-hooks. Anterior femora marked with yellow on the outer surface.

Wings hyaline, the apices tipped with a faint smoky brown. Membrane black. Stigma blackish brown. Subtrigones with 4 cells; antenodal nervures 15½.

Abdomen black marked with bright yellow as follows:—A triangular spot on the dorsum of the 2nd segment, the intersegmental node between the 2nd and 3rd and the transverse ridge on the 3rd segment finely yellow, a series of dorsal, geminate spots on the 2nd to 9th segments, gradually enlarging as traced analwards and gradually approaching the proximal ends of the segments, oval yellow spots on the borders of the 2nd to 6th segments, very large on the sides of the 3rd and decreasing rapidly in size as traced analwards, the 10th segment black. Anal appendages black. Beneath the abdomen, the yellow bordering spots on the upper side are found to extend inwards as far as the pleural membrane.

Sexual organs: male: lamina a broad, somewhat depressed arch, notched at the border; tentaculæ; the internal a long, slender, strongly curved hook, the external broad and foliate; lobe rather small, projecting and bearing a stout, blunt spine at the apex.

Female: border of 8th segment not dilated; no distinct vulvar scale, the 8th ventral plate minutely bilobed; the 9th ventral plate overlapping the 10th and bearing near its middle, 2 small, stout, spinous processes.

Hab. Ceylon, Nilgiris, Kalar 2,500 ft. The insect is very local and very scarce. I have seen five specimens only of which I captured one and that only after stalking it for two hours up to my middle in a swift mountain stream where the boulder strewn bottom made progress both arduous and dangerous. It is quite the most wary dragonfly I have ever attempted to take, and its wariness is only equalled by its restlessness. The species is found haunting deep ravines at the foot-hills, in dense jungle and always settling, after short flights, over deep water.

(*To be continued.*)

SOME NEW MAMMALS FROM MESOPOTAMIA.

BY

OLDFIELD THOMAS, F.R.S., F.Z.S.

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Among some mammals obtained by members of the Mesopotamian Expeditionary Force, and submitted to me for determination by the Bombay Natural History Society there are examples of the following five new species. In pursuance of its habitual public-spirited policy the Society has presented all the types to the National Museum.

1. EPTESICUS HINGSTONI, sp. n.

A small form of the *serotinus* group.

Size decidedly smaller than in the Persian form of Serotine previously determined as *turcomanus* of Eversmann, with which *mirza*, Fil. is probably synonymous.

General colour "buffy brown," the hairs slaty with dull buffy ends. Undersurface rather lighter, the hairs slaty, tipped with pale drabby or drabby whitish. Inguinal region dull whitish to the bases of the hairs. Membranes and limbs brown, the hinder edge of the interfemoral whitish.

Ears of medium size; inner basal lobe convex forwards, front margin straight, tip narrowly rounded off. Tragus shaped about as in *E. serotinus*. Wings to the bases of the toes. Tail with two vertebræ exserted. Posterior rump naked; a deposit of fatty matter present in this region.

Skull broad, low, with flattened muzzle and widely expanded zygomata, but in these respects it is less marked than in *E. serotinus* and *turcomanus*, more than in the Egyptian *E. innesi*.

Incisors as in *turcomanus*, the outer pair much smaller than the inner, the outer pair standing so that their front edge is on a level with that of the inner.

Dimensions of the type, measured on skin:—

Forearm 45 mm. Third finger, metacarpus, 43; first phalanx, 14·3; second phalanx, 13·5.

Skull, greatest length, 16·7; condylo-basal length, 16·2; zygomatic breadth, 12; intertemporal breadth, 4; breadth of braincase, 8·2; mastoid breadth, 9·2; front of canines to back of m^3, 6·3; front of p^4 to back of m^2, 4·1; breadth across m^2, 7·7.

Measures of a spirit specimen (male):—Head and body, 59; tail, 40; forearm, 45; ear, 15·5; tragus on inner edge, 5·5; lower leg and foot (c. u.), 27.

Habitat.—Mesopotamia. Type from Baghdad, two other specimens from Basra.

Type.—Adult skin. B. M. No. 19. 3. 1. 1. Original number 304. Collected by Captain Hingston, I.M.S.

This bat, which is named in honour of its first captor, presents an intermediate stage in size between the small *E. innesi* of Egypt and the *E. s. turcomanus* of Persia. *E. shiraziensis*, Dobs. of S. W. Persia is again larger still.

2. EPTESICUS WALLI, sp. n.

A small pale coloured species allied to *E. pellucens* and *matschiei.* Size rather larger than in *E. pellucens.*

General colour, so far as can be observed on a spirit specimen, very much as in that species, with sandy buffy back, buffy whitish undersurface, and translucent membranes, pale brown for the most part, then becoming whitish along the hinder edge of the wings and on the posterior third of the interfemoral. Forearms, tibiæ, and tail, dark brown.

Ears rather short, triangular, the front edge nearly straight, the tip narrowly rounded off, almost pointed, the outer edge slightly convex; outer basal lobe little developed. Tragus of medium height, its outer margin slightly convex, with scarcely a trace of basal lobule, tip rounded, inner margin straight. Wings to the base of the toes. Wing membranes near the body, and interfemoral numerously studded with warts, similar to those in *Rhinopterus*, and there are a certain number of warts on the forearms and tibiæ. A narrow postcalcareal lobule present. Middle third of tail with an elongated thickening about half an inch in length either of a glandular or a fat-storing nature; a similar structure seems to be present in *E. pellucens*, so far as can be judged from skins.

Skull closely similar to that of *E. pellucens*, but markedly larger and heavier in all dimensions. Upper inner incisors thick, unicuspid, but worn at the point in the type.

Dimensions of type, measured on the spirit specimen:—

Fore arm, 40 mm. Head and body, 55 mm.; tail, 42; ear, 13; tragus on inner edge, 4·3; third finger, metacarpus, 38; first phalanx, 11·7; lower leg and foot (c. u.), 23·3.

Skull, condylo-basal length, 13·7; basi-sinual length, 11; zygomatic breadth 10·4; interorbital breadth, 5; breadth of braincase, 7; breadth across canines, 4·8; across m^2, 6, 5; front of canines to back of m^3, 5·3; front of p^4 to back of m^2, 3·7.

Habitat.—Mesopotania. Type from Basra.

Type.—Adult female in spirits, B. M. No. 19.3.1.2. Original number M. 17. Collected by Lieut.-Col. F. Wall, I.M.S.

This species is most nearly allied to the bat I described as *Vespertilio matschiei pellucens*, but its skull and dentition are so much larger and heavier that it should evidently be separated. The characters now observed on the spirit specimen also indicate that *pellucens*, of which we previously only had skins, should be considered as a different species from *matschiei*.

The presence of warty excrescences on membranes and limbs is an interesting character, recalling the condition in *Rhinopterus*, but the skull is shaped quite as in other small *Eptesicus*, and not as in *Rhinopterus*. It is possible however that species elsewhere referred to *Rhinopterus* on account of the presence of warts, (e.g., *Scabrifer notius*, G. M. Allen. Bull. Mus. Harv. LII. p. 46. 1908), are also, as in this case, members of *Eptesicus*.

3. PIPISTRELLUS COXI, sp. n.

A Pipistrel with a whitish undersurface, near *P. rüppelli*.

Size and general colour about as in *P. rüppelli* and *nigripes*, though the back is more broadly washed with sandy buff, so as to hide more completely the dark bases of the hairs. Undersurface wholly buffy whitish, the hairs whitish to their roots.

Ears and limbs black; membranes brown, not whitish.

Skull, compared with that of *P. rüppelli*, smaller, with shorter and less inflated braincase. Muzzle broad and flat, the supraorbital ridges well developed, and continued backwards to form a perceptible sagittal ridge, though the specimen is not old. Below, in agreement with the shortened braincase. the distance from the back of the condyle to the palation is 6·7 instead of about 7·2 mm.

Teeth very much as in *P. rüppelli*; inner incisor large, bicuspid. outer small, not surpassing the cingulum of the inner; small premolar visible from without.

Dimensions of type, measured on skin:—

Forearm, 33 mm. Third finger, metacarpus, 30, first phalanx, 11·6, second phalanx, 10.

Skull, greatest length, 12·8; condylo-basal length, 12·1; basisinual length, 9·8; interorbital breadth, 4·9; intertemporal breadth, 3·7; breadth of braincase, 7; front of canine to back of m^3, 4·8; front of p^4 to back of m^2, 3.

Habitat.—Mesopotamia. Type from Bart Mahommed Chakala, Amara.

Type.—Adult skin. B. M. No. 19.3.1.3. Original number 151. Collected 20th March, 1918, by Major R. E. Cheesman, and forwarded by Sir P. Z. Cox.

This bat is not related to any known Asiatic species, but seems to be the northern limit of a series beginning with the Uganda *P. fuscipes*, which has a large and much inflated braincase, through the Egyptian and Soudanese *P. rüppelli*, in which the brain case is more normal, while in *P. coxi* it is distinctly smaller than usual. Colour and other characters seem much the same in all.

Named in honour of Sir P. Z. Cox, to whose assistance the obtaining of a number of the Mesopotamian specimens is due.

4. Paraechinus ludlowi, sp. n.

Nearly allied to *P. dorsalis*, And. and de Wint., but far paler.

General essential characters as in *P. dorsalis*, these, of course, including the peculiar enlarged bullæ and hollow pterygoids characteristic of *Paraechinus*, as compared with *Hemiechinus*, to which the other and more common Mesopotamian hedghog, *H. auritus*, belongs.

Size about as in *dorsalis*. Coloration on the same plan as in that animal, there being similarly a darker median dorsal area with light sides. But on the darker median part, which is about 1-2 inches broad, the spines have only one subterminal dark band (about 4 mm. in length and beginning 4 mm. from tip of spine) instead of two, those of *dorsalis* having a second dark band lower down. And on the light coloured sides the spines are for the most part completely white, without any dark band at all, those of *dorsalis* having here always one dark band and sometimes a second one. Spines of back about 24 mm. in length. Undersurface wholly white. Muzzle and a narrow line up forehead brown. Limbs whitish, darkening terminally.

Skull, so far as can be judged from a somewhat immature example, quite like that of *P. dorsalis*.

Hindfoot, as measured by collector, 34 mm.; ear, 43.

Skull (immature), greatest length, 49·5; condylo-basal length. 49; zygomatic breadth, 28·7; nasals 14·5 × 3·7; interorbital breadth, 12·5; palate length, 25·6; upper tooth series, 25·2; front of p^4 to back of m^2, 11·7.

Habitat of type.—Hitt, on the Euphrates, about 100 miles West of Baghdad. Altitude about 400′.

Type.—Immature male, B. M. No. 19.3.1.4. Original number 4. Collected 8th August, 1918, by F. Ludlow.

This hedghog, which is widely different from the common *H. auritus*, seems to be only related to *Paraechinus dorsalis*, discovered by Mr. Theodore Bent in the Hadramaut, S. Arabia. It differs, however, so markedly in coloration that it should evidently be distinguished specifically.

5. Gerbillus cheesmani, sp. n.

A Gerbil with the general appearance of *G. gerbillus*, *gleadowi*, and *andersoni* but with larger bullæ and smaller teeth than any of them.

External characters very much as in *G. andersoni*, with which the species shares the more normal proportions of the feet and the less tufted tail as compared with the common Egyptian Gerbil, *G. gerbillus*. Colour as usual bright sandy buff above, pure white below, the hairs of the sides tipped with buffy, and the hairs of the middle of the back alone slaty at base. Usual white eye and ear patches present. Palms and soles with the hairy covering longer than in *andersoni*, less close and fine, but this may possibly be due to confinement. Tail pale buffy white above, pure white below, the terminal tuft little developed, faintly brown above.

Skull, as compared with those of the other species, distinguished by the greater size of the bullæ, which project backwards beyond the level of the most posterior part of the occiput, which is not the case in any one of them. This gives quite a different aspect to the skull in the upper view. Supraorbital ledges strong and heavy, even more so than in *andersoni*, and much more than in *gerbillus*, and with marked postorbital projecting angles, at least in the type, which is an old individual. Molars remarkably small for the size of the animal, and though the specimen is old and the teeth worn, there does not seem evidence that they are materially shortened antero-posteriorly.

Dimensions of type:—

Head and body, 94 mm.; tail, 132; hindfoot, 26; ear, 13.

Skull, greatest median length, 29·5; greatest diagonal length, 29·8; condylo-incisive length, 26; zygomatic breadth, 16·2; nasals, 11·1, interorbital breadth, 5·2; breadth of braincase, 13·8; bi-meatal breadth, 15·3; palatal foramina, 4·7; bulla, greatest longitudinal diagonal length, 11; breadth at right angles to last (exclusive of meatal projection), 6·4; upper molar series (worn), 3·4.

Habitat.—Mesopotamia; exact locality not recorded.

Type.—Adult male, B. M. No. 19.3.1.5. Lived for a short time in confinement and died 21st August, 1917, in Bombay. Presented by Major R. E. Cheesman.

This Gerbil is practically indistinguishable externally from *G. andersoni*, but is readily separable by its larger bullæ and smaller teeth. In the common *G. gerbillus* the tail is more tufted and the proximal part of the foot is peculiarly slender, with the distal part broadened, while in *andersoni* and *cheesmani*, the proportions are more normal. The Sind *G. gleadowi* is a less bright buffy and has a tail nearly as much tufted as *G. gerbillus*.

But in none of these allied species do the bullæ project backwards beyond the line of the occiput, as they do in *G. cheesmani*.

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THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I.F.S.

(*Continued from page* 487 *of Vol.* XXVI.)

PART XXIII.

29. Genus—THADUKA.

"Allied to *Mahathala,* Moore. Fore wing: short, broad; costa convex at base, apex acutely angled; exterior margin erect, scalloped; posterior angle lobular; hind margin the same length as the costal, concave in the middle. Hind wing: short, broad; anterior margin convex; apex and exterior margin very convex, sinuous, with three prominent tails, the middle one longest; anal lobe large; abdominal margin very concave above anal lobe.... Body short, stout. Antennæ uniformly thickened to the end. Palpi slender. Legs short. Eyes naked." (*Moore.*)

The above is taken from de Nicéville's book. The author adds "This is a very aberrant genus and, as far as I can ascertain, may be known from all others occurring in India (except some species of *Iraota,* Moore) by having three very distinct tails besides a large, anal lobe to the hind wing. A single species of *Thaduka* only is known up to date and it occurs in Upper Tenasserim."

The above was written in the year 1890 or thereabout by de Nicéville and there is still only the one species in the genus. It has since been taken in the Kanara District of Bombay, where it has also been bred from the larva and egg. The original description was written by Moore from a female and, until bred in Kanara, no males had been taken or seen. The larva is similar to that of *Arhopala centaurus* and *amantes* in shape, but the markings are characteristic. The pupa is normal and the suspension is by the tail and a body-band. The larva feeds upon the euphorbiaceous *Trewia nudiflora,* a very large tree of damp places.

183. Thaduka multicaudata, Moore. Male. *Upperside:* black, with the basal area smalt-blue or silvery blue; otherwise the colour of the wings is blue with a very broad, black, borders covering all, but the basal, discoidal, and submedian areas. *Cilia* and tails also black. *Underside:* dark vinous-brown. Fore wing: with the outer half and lower portions paler, three green spots in the basal half of the cell, a larger one at the end with a brown dot inside it; a discal band of six separate, square spots from the costa to vein 2, the first two outwardly oblique, the third outside them; the next three, a little on the inner side of each other; a submarginal series of acutely angled marks. Hind wing: generally darker than the fore wing, with three outwardly-curved, irregular bands of separated spots with pale edges, antemedial, medial and discal, often very indistinct; anal area with some bronzy or bluish scales and a few similar scales near the base and sometimes on other portions of the wing.—Female. Exactly similar in shape, colouration and markings. Antennæ black; palpi black above, two basal joints grey beneath; head and body black above, brown beneath. Expanse: 40 mm. to 48 mm.

Egg.—Is similar in shape to that of *Arhopala centaurus* and *amantes, i e.,* it is dome-shaped, but broadest just above base. It looks, however, to be turbanshaped and flat on top. And the reason for this is that there are two rows of long, delicate, feathery-looking spikelets, finely bifurcated at the tips, placed at right angles to the polar axis of the egg and slightly converging, one row towards the other, at the points. There are 2 cells from the base to near the summit of the egg and these spikes are situated where the walls of the middle row of cells intersect with the walls of the top row of perfect cells and the bottom row of half-cells. On the summit the egg is pitted and has a rather large, central, circular, depression (micropyle). All the cells are large, nearly regularly quadrilateral with rather high, fine walls and are flat-bottomed. The cells round the equator are ten in number. The colour is finely granulated green, the walls of cells and spikes being white. B.: 0·6 mm.; H.: 0·4 mm.

Larva.—The larva agrees in all respects, in *shape* and habits, with that of the species of the genus *Arhopala* as represented by *centaurus* and *amantes*. The *head* is hidden beneath segment 2, is shining black and rather large. Segment 2 is semi-circular in shape, very slightly emarginate in the dorsal line of front margin and the central dorsal depression is semi-elliptical in shape with the convexity forwards, velvety black in colour and with a dorsal, green line; segment 3 somewhat suddenly higher and broader than 2; segments 4-11 nearly of coequal breadth and length; segments 12-14 decreasing in width, the anal segment rather flat, dorsally and thickened round the free margin, broadly rounded at extremity with a square velvety-black dorsal patch bisected by a fine, green, dorsal line. The whole larva is depressed, being of the same height from segment 4-10, both inclusive. The *surface* of the body is covered with minute, short, light-coloured, sparsely-disposed, star-shaped hairs; on the black patches they are denser than elsewhere and black; laterally corrugated with some rather deep pitting on the dorsoventral margins; the whole dorsoventral margin set with distant, long, simple hairs; the gland of segment 11 large and conspicous, surrounded by an oval, deep-black patch which has a thin, green line just inside the circumference the whole way round and the axis of which is transverse; the organs of segment 12 circular-mouthed, protruding on occasions little white cylinders. *Spiracles* are plainly visible, rather longly oval in shape and yellow in colour. The *colour* of the larva is light green with a dorsal, dark-green line flanked on either side by a subdorsal, white line; a laterodorsal white line; a lateral white line; all six lines commencing on segment 3 and ending just in front of the gland on segment 11; the space on the dorsum between the lateral and subdorsal, white lines is obscurely rose-coloured. Before the change to pupa the colour changes to a brown-pink. All the segments are distinct. L: 19 mm.; B: 5·5 mm.

Pupa.—The pupa is more or less normal in *shape*. The *head* is bowed towards the ventrum and is hidden from above by segment 2; segment 2 is large, very convex transversely, the front margin semi-circularly curved, the dorsal ascent towards thorax in the same plane as the ascent of the front slope of thorax; thorax ascending in a gentle curve to apex, the apex rounded, then descending evenly to segment 5, the descent including segment 4; the dorsal constriction at segment 5, slight laterally nil; dorsal outline from segment 5 to 8 straight to descend gradually thence to segment 10 after which it falls nearly perpendicularly to the longitudinal axis of pupa, the change in direction of course gradual and rounded; laterally the pupa increases in breadth from the head to the slightly angular shoulders, then more still though only slightly to segment 7 and 8 after which it gradually decreases to end; the extremity rounded and not broadened out hoof-wise though closely applied to the surface of suspension. *Surface* covered with very minute, tubercular granules which sometimes coalesce into lines; the shoulders each with a small tubercular swelling ; gland-scar and scar of organs of segment 12 conspicuous. *Spiracles* of segment 2 small, linear, facing forwards ; other spiracles with swollen lips, oval, conspicuous, light-brown in colour. Colour of the pupa is very dark rosey-brown, lighter on the abdomen and dorsum generally ; a light-brown, dorsal line on segments 2-4 ; a row of two or three light-brown spots parallel to the segment margins on each side of the dorsal line on segment 6-10 ; ventrum light rosey brownish-yellow. L : 14 mm. ; B : 6·5 mm. at segment 7 ; H : 5·3 mm. at apex or thorax. The breadth at shoulders is 5 mm.

Habits.—The eggs are laid singly or in twos and threes on leaves, leaf-stalks, stems and twigs, even on the trunk of the trees and, in this case, in crevices or cracks. One female often lays many on the same tree. The butterfly is fond of the sun and sits for long periods on the same leaf basking with closed wings, sometimes on a twig, stem or trunk of a tree ; with care it can then be caught between the fingers ; but, once on the wing, its flight is extremely rapid though not sustained. The larva from the first moult makes a house or shelter for itself by turning over a bit of the edge of a leaf, fixing it down and lining the inside with silk ; it then ornaments the house by eating holes all round through both layers except on the outer side, where the hinge is. It makes new nests as required, feeding always upon the tender leaf on which is made its abode. The piece of leaf is either turned over onto the top or bottom, it seems immaterial to the caterpillar. To pupate it wanders off to some crevice in the bark, hole in the tree, or even down to the ground, where it gets under a dead leaf, clod of earth or stone, or into a hole A dozen or more pupæ are sometimes found together. The butterfly is difficult to kill by squeezing for some reason or other—like the protected danaine insects ; it is the only lycænid insect of these papers that has this property. Some of the larvæ are attended by ants of the genus *Cremastogaster*, some are not ; the ants do not seem to care much for them as they leave them at the slightest sign of danger. The pupæ are, also, sometimes attended by these same ants. The reason the butterfly is rare is, probably because the tree upon which the larva feeds is, as a general rule, about 150 feet in height with a clear stem of some 60 feet or more and the butterflies keep to the tops. The reason for success in obtaining the larvæ for the first time in Kanara was that extensive cutting of the tree had been going on and there were large areas on which stool-shoots were coming up plentifully. The young leaves attracted the females and so the discovery came about during the writer's walks over the cuttings. The range of the butterfly is limited as it is only recorded from Tenasserim in Burma, the Nilgiri Hills in Madras and Kanara in Bombay. Up to the time of the discovery of the larva the female only was known. There is absolutely no difference in the sexes in the matter of shape and colour.

30. Genus—Zeltus.

Eyes hairy; body small and rather weak ; antennæ short, considerably less than half the costal margin of the fore wing. The type and only species of this genus is a much more weakly constructed butterfly than the species of *Hypolycæna* says de Nicéville. But as we do not know what that means, not knowing any of this latter genus, it does not help us much. *Zeltus* is a weak-flying, fluttering little insect that plays about in the shade and often near water in the monsoon months on the Kanara coast, sitting on leaves at about ten feet from the ground and occasionally flying off for a short distance to return again to the same point of vantage. It comes occasionally to flowers but, on the whole, is rarely seen at all. It is not to be mistaken for anything else as it has two very long, white, feathery tails to the hindwing, one at the end of vein 1, the longer by double, the other at the end of vein 2, fully 6 mm. or 7 mm. in length ; about one-quarter inch. The description below will explain the rest. This beautiful and delicate little butterfly has been bred as both Horsfield and Moore give figures of it, but they do not state what the larva feeds upon ; and the writer has never had the luck to come across it. It is found all over India, in Burma, the Malay Peninsula, Niass Island and in Java and Borneo.

194. Zeltus etolus Fabricius. Male.—*Upperside* : fore wing : black, with a bluish base ; hind wing : light blue and silvery, with an oblong, abbreviated, black patch at the outer apical angle ; two circular, distant, subocellate spots at the anal region. *Underside* : fore wing with the greater portion of the surface testaceous-brown, separated by an oblique boundary from the bluish base ; surface marked with a short, double band on the discocellular nervules ; a distinct, abbreviated, medial, and a faint, almost complete, submarginal band, all these marks darker than the ground. Hind wing : pale blue with a whitish lustre ; bearing, near the base, in contact with the costa, a very distinct, black dot enclosed in a faint, whitering ; a short, broad band on the discocellulars as in the fore wing ; a postmedial, complete band of the similar colour straight from costa to vein 3, then displaced inwards, then hook-shaped, directed somewhat outwards from the base of vein 3 and along it, then down, recurved and back and up to about the middle of vein 2, then down, for a short way and, after a curve, up and diagonally straight to the middle of the inner margin as a deep-black line ; followed by a submarginal and marginal, much finer band, one outside the other, the inner terminating in a distinct oblong, transverse streak in interspace 1 between and above the tails, the outer having a small, black portion in interspace 3 about the middle of the margin, followed in the same line by two very large, intensely black ocelli or round spots, the first in interspace 2 just above the base of the upper tail, the other on the anal lobe ; between them, in interspace 1, the space covered with white irroration, most thickly disposed and covered with a greenish-silvery powdering on a wedge-shaped dash at the edge of the anal ocellus, the dash having its point directed inwards. Body brown above, sparingly clothed with bluish hairs, whitish and downy underneath. Antennæ brown, delicately ringed with white to the club, which is rusty red at the tip. Legs banded alternately black and white.—Female. *Upperside*: both wings dull, smokey brown. Hind wing: with the abdominal margin whitish, very hairy; the outer margin bearing, from vein 3 to the abdominal margin, a double series of somewhat quadrate, white spots; followed, on the margin, by a small, black spot in inter-space 2; a large, intensely black, rounded spot in interspace 1; thence to the inner margin irrorated with black scales; the anal lobe with an oval, ochreous spot; a very fine, black, marginal thread from the anal angle to vein 5, inwardly defined with white. *Underside*: both wings marked as in the male, but the ground-colour of the costa and anterior half of the fore wing and the apex of the hind wing, more ochreous than in the male. *Cilia* on the upperside of fore wing dull brown, on the underside paler; on the hind wing dull brown at the apex, thence pure white to the anal angle. Two tails in both sexes, white throughout in the male, the one at vein 2 long and faintly marked with blackish down the middle in the female; the one at the end of vein 1 twice as long, more prominently marked with black, that colour disappearing towards the tip. Expanse: male, 30-38 mm.; female, 35-40 mm.

Larva.—Green, hairy, depressed; head black, second and third segments increasing in size; marked with short, black lines; the following segments of equal size; the three last ones dorsally flattened and marked above with crimson.

Pupa.—Of the usual lycænid shape; yellowish-green; head and thorax emerald-green.

The description of the transformations are from Horsfield and Moore's figures and are given in de Nicéville's book.

Habits.—All that is known to the writer has been given already under the description of the genus. de Nicéville says that it occurs commonly at low elevations in Sikkim and he remarks that it flies rapidly and compares it to a dragon-fly! It does not really fly rapidly.

31. Genus—RATHINDA.

"The genus *Rathinda* contains but a single species which is brown on the upperside with an oblique, transverse, discal, macular, white or ochreous band on the fore wing and a submarginal, reddish-ochreous band on the hind wing. The underside is very beautifully marked, the apex of the fore wing is ochreous-brown, the base of the fore wing and the entire hindwing is sometimes pure white, sometimes pale ochreous-brown or greyish-ochreous, sometimes entirely ochreous, marked with dark, ochreous-brown lines, patches and spots; the hind wing with a submarginal, metallic, silvery-green line. There are three tails, the middle one twice as long (4 mm.) as the others. The male has no secondary characters." The larva is very abnormal having many fleshy processes, long and conical in various positions; the pupa is of the type of *Tajuria* and *Camena-Ops-Creon,* fixed only by the tail and standing free thereon. The butterfly is a weak, fluttering flier and is easily caught; it is confined altogether to the underwood but is found from sea-level up to the 3,000′ hill-tops and even out into the borders of the opener country on the Western Ghats in Bombay; which means from the region of 100 to 300′ and over of rainfall to where it is but 60″ or even less and from the Malayan scrub jungle of the coast through the very densest and tallest evergreen forest into more or less Deccan scrub on the other side; it extends from Assam through Orissa and is found throughout Southern India and Ceylon in suitable places. The foodplants are numerous.

185. Rathinda amor. Male. *Upperside*: brownish-black with a violet tint. Fore wing: with a white spot, often with ochreous scales upon it and more or less trapeze-shaped, placed obliquely just beyond the cell in interspaces 4, 5, with two more, smaller, generally slightly blurred and in a curve downwards and outwards, in interspaces 2, 3; a slight fringe of sparse, glistening, brownish hairs along the inner margin; a fine, anteciliary, black line; the *cilia* light, glistening brown, pure white under the apex and just before the tornal angle. Hind wing: with the abdominal fold light brown as well as the costa very narrowly; a band of red-orange, subterminal, in interspaces 1 to 5 thinning upwards, sometimes wanting in the higher interspaces, sometimes continuous, sometimes consisting of separate lunules capping terminal brown spots or even, in the first three interspaces, black, terminal spots; these spots whether brown or black bordered by pure white, fine lines exteriorly in interspaces 1 to 3; a fine, anteciliary, brown line; the *cilia* pure white outside the spots, grey in the middle of the outer margin, brown towards the apex; a thread-like tail, the middle one 3·5 mm. in length, at the ends of each of the veins 1, 2, 3, the outer half as long as the middle one, the innermost shortest; all brown, tipped with pure white. *Underside*: white, the markings brown, both wings often suffused with golden ochraceous. Fore wing: the apical third brown, the inner edge an even, outwardly convex curve from the middle of the costa to about a quarter of the length of the inner margin from the tornal angle; this area in some specimens completely suffused with golden-ochraceous and always with a subterminal black, straight line, interrupted at the veins, bordered inside by a fine, white line of equal breadth; the area beyond nearly always suffused with golden-ochraceous forming the terminal outer border, limited by a fine, dark-brown, anteciliary line; the *cilia* light brown. The inner border of the white is often irregular, sometimes nearly straight, diverging from the outer border to vein 1 or beyond and with a twice-waved, thin line of brown near the outer edge of it in interspace 1; inside the pure white, discal band thus formed there is a large, brown patch between vein 1 and 4, more or less quadrate in shape, sometimes invading interspace 1 below somewhat, not extending further in than the base of vein 2 with two brown spots above it in interspaces 4, 5 which border the discocellular nervures; these nervules bordered on the inside by a more or less triangular brown spot often connected with the large brown patch below; in the cell are two brown spots one under the other beyond the middle and, below them in interspace 1, touching the median nervure, is a quadrate or transversely elongate, subbasal spot; a basal, brown line along the underside of vein 12 and another line, parallel to it and twice waved, extends from vein 1 near the base of the wing to the subcostal nervure in the middle of the cell. The whole wing at the base from the median nervure upwards to the costa as far as the discal, white band may be suffused with golden ochraceous and the brown spots on the white ground-colour are then often bordered by ochraceous. Hind wing: proceeding inwards from the outer margin the markings are as follows:—*cilia* pure white with an anteciliary, very fine, brown line; a terminal moderately broad, golden-ochraceous band bordered inwardly by a fine, jet black line from costa to vein 1: a submarginal, light bluish-silver, complete, rather fine line turning up at the anal end to the anal angle and touching the terminal, ochraceous band in the middle of the outer margin, the space between it and the outer margin is white, often with ochraceous scales on it here and there, in interspaces 1*b*, 1 and 2 often with a black spot overlying the white, the central one always the largest, sometimes obsolecent, but, if present, bordered on the outside also by silver; this submarginal band bordered inside by a fine, chocolate-brown, more or less lunulate, continuous, fine line; both this. subterminal band and the inner brown border turn up at the end in an even curve to the inner or abdominal margin; a highly-lunulate, thin, chocolate, postmedial line curving from the costa out and in to the middle of the abdominal margin, the convexity of the lunules outwards and the interspaces 6, 7 often suffused outwards with chocolate; inside this is a medial curved series of lunulate, quadrate and elongate spots from the costa to the abdominal margin, the abdominal end in the shape of an angulated band; a chocolate line on the outside of the discocellulars and another, often produced triangularly inwards in its upper half, inside the discocellulars a spot above these discocellular markings in interspace 6; inside these again a subbasal chocolate line across the middle of the cell continued interruptedly above to vein 7 and below to the abdominal margin; spot in base of cell, one above and below; and, finally, a chocolate streak along the middle of interspace 8 parallel to the costal margin. The whole disc may be suffused with golden-ochraceous leaving the chocolate spots and marks intact.—Female: like the male but the white band on fore wing purer white and larger; the underside generally paler. Antennæ black, banded with white; the club thin, rounded, tipped broadly orange; palpi black above and on sides, light ochreous or white below; head with vertex and frons black, bordered white; abdomen and thorax black above, white below. Expanse: male, 24 mm; female, 30 mm. or less.

Egg.—Depressed—hemispherical in *shape*; four rows of more or less hexagonal, thick-walled cells from summit to base; the bottom row smallest and irregular; the top row arranged round an apical cell which is a little larger than the others and contains, within its confines on the flat bottom, a circle of six, very small cells with broad, low walls round the micropyle which is the absolutely central pit. Each cell has a concave bottom covered with tiny, impressed, greenish pitting. The walls of all the large cells are coarse and rather irregular, rather high and of rounded transverse section. The whole *surface* shining. The *colour* white over the green ground. B.: 0·75 mm; H. 0. 5mm.

Larva. (Pl. II, fig. 27.)—In general *shape* the larva resembles those of *Tajuria cippus* or *Creon cleobis* being broad in the anterior segments, narrowed to a waist in about 8, 9 and broadened out again in 12; but the segments are perhaps not so well-marked and the surface is dull instead of shining. The *head* is hidden under segment 2, rather small, round, shining yellow in colour with a large, triangular clypeus, black eyes and labrum, jaws tipped with brown-red. Segment 2 is hood-shaped, semi-circular in outline, depressed in dorsal centre in a square with a dorsal line down its centre of a different shade to rest; the margins, therefore, somewhat tumid, the dorsal line on front margin narrowly emarginate with a small subdorsal, fleshy point on each side of the emargination pointing forwards. The anal extremity is square and practically hidden from above by the dorsally flattened, marginally somewhat tumid, posteriorly broadly-truncated segment 13 (?); segment 12 is convex on dorsum, otherwise somewhat gibbous, which means higher than the preceding and following segments; segment 3 has two, short, subdorsal, fleshy, pointed-conical processes, one on each side of dorsal line in middle of the segment; segment 4, broader and higher than segment 3, has a similarly situated pair three times as long—which means about as long as the larva is high; one, dorsal, the same length on segment 5; one, dorsal, still longer than that of segment 5, on segment 6 as well as a subspiracular one of the same length; one, dorsal on each of the segments 7-11; that on 7 a mere, short triangular cone; those on 8, 9 of normal shape, but rather short and between that of segment 3 and that of segment 4 in length; that on 10 longest of all, slightly longer than those of segment 6; that on 11 the same length as the one on segment 3 or even shorter; segment 12 has a subspiracular one directed slantingly backwards with an upward tendency; the process on segment 3 is slightly curved and erect, leaning slightly forwards; on segment 4 is erect, leaning forwards, slightly hooked at tip; on 5, erect; on 6 also vertical as concerns the dorsal one, the subspiracular being directed straight out in the horizontal plane; those of segments 8, 9 curved, leaning forwards; that of 9, vertical; of 10, situated near the hinder margin, leans backwards, curved forwards slightly. *Surface* of the larva is shallowly pitted all over and transversely creased; covered fairly closely with minute, thick-based, erect hairs, these hairs occasionally inclined towards the surface; the dorsoventral margins of segments 2 and 14 are set with erect, light-coloured, short hairs; on other segments they are light brown and somewhat longer. *Spiracles* broadly oval, rather small, flat, raised upon slight corrugations of the body, greenish light-brown in colour. *Colour* of the body is grass-green with a broad, enamel-white dorsal band increasing in width from the hinder margin of segment 6 to segment 12; this band on 7-9 bordered by rose-brown stretching down each side on segment 9; the dorsal process of 5 has a brown-rose band from its base down each side to behind spiracles; processes on 6, 10 (dorsal) are green at their bases, yellowish above and red at tips and are nearly 3 mm. in length. The ground-colour may also be rose-red—it depends upon whether the larva is feeding on green leaves or red ones, or green or red flowers. L: 17 mm; B: 4 mm without the processes.

Pupa.—(Pl. II, fig. 27*a*). This is also of the *type* of those of *Tajuria cippus* or *Creon cleobis*. The *head* bowed ventrally, hidden from above by segment 2; the frons rather prominent, rounded. Segment 2 is a rather broad, transversely convex band or piece, rounded in front outline, with a straight posterior margin except for a shallow wave forwards in dorsal line; it is 2/3rds as long as broad and inclined at an angle of 45° to the plane of the head-frons and 30° to the longitudinal axis of the front half of pupa; the thorax is of ordinary length, is prominently humped, smooth, the hinder margin with its two halves meeting at a right angle in the dorsal line; each half again meeting the wings in a widely rounded, deep angle of about 60°; segment 4 dorsally flat and parallel to the plane through the spiracular lines at that point; segment 5 ascends to segment 6 which is again humped in the middle; here the pupal axis is suddenly bent at nearly a right angle to that of segments 1-5 and the body gradually becomes thinner in diameter to the hinder margin of segment 9, then remains perfectly cylindrical to the end, segments 10-14 forming a sort of thick stalk longer in some pupæ than in others, segments 12-14 being cut away ventrally obliquely to form the attachment surface; ventrally the angle of the bend is at the ends of the wings: at segment-margin 8/9 that is, but even here the angle is rounded and not sharp; the dorsal line of segments 6-14 is quite straight as is the ventral line of 1-8 and the continuing line of 9-14; laterally the outline is from shoulders to segment 6 nearly parallel; the sides converging thence to anal end; the last segment dilated, horse-hoof-shaped. The *surface* of the pupa is shining, minutely, irregularly and shallowly creased with short, lowly-conical, paired tubercular unevennesses on segments 6-9 and some further, minute warts on the coloured band of the same segments; segment-margins 8, 9 are bevilled, the posterior one of segment 8 much more than the front one of 9 and suddenly raised above it dorsally. *Spiracles* of segment 2 are small, oval, raised, light brown or whitish in colour; the rest are roundish, small, raised, similarly coloured. *Colour* of pupa is ordinarily grass-green;

the ventral edge along the dorsal margin of the wing suffused with whitish grey ; a brown spot dorsally behind apex of thorax and a similar spot at front margins of segments 10, 11 ; the larval band on the dorsa of segments 7-9 white, suffused with light pinkish-brown. Sometimes, when the pupa is formed in artificial conditions in a breeding cage or away from green leaves, it is suffused all over with blackish or very dark grey, the ventral margin of the dorsal margin of wings is broadly lighter as well as the dorsal band of segments 7-9 except the little tubercles and the dorsal, hinder part of segment 3. L : 9 mm ; B : 4 mm for a fat pupa ; 8 mm and 3·5 mm for a thin one.

Habits.—The egg is laid as usual in the axil of a flower or leaf, always of young flowers or leaves. The egg-larva eats flower-buds and very tender leaves. When full-grown lives amongst flowers or on the undersides of tender leaves. It is sluggish and never wanders very far for food if it can help it. The pupation is effected on the upper surface of a leaf or on a perpendicular stalk or wing, &c., and the head always points up. The tail only is fixed but it is fixed very strongly and the pupa stands quite free upon it. Some of the pupæ are thin and stand out at quite an angle from a perpendicular surface (say, 15° which is a lot), others are quite stout and then the head rests generally against the pupating-surface or very nearly. In the larval stage there does not seem to be any gland on organs on segment 12 and ants are certainly not particularly attracted by either the caterpillar or chrysalis. When the pupa is touched it gives vent to a little knocking noise ; even, sometimes, when blown upon. This noise must be produced by some action in the joints of the segments 8-11 because the pupæ that stand quite free, not touching with their heads, omit it. The larva is of rapid growth and the butterfly emerges after about a week from pupation.

Ratinda amor is one of the prettiest little insects to be found and it is one of the commonest in the jungles of the Bombay Presidency. It would be hard to beat it for delicacy of build and neatness of colouring : the little waving tails and brightly varied pattern of the undersides impart to it an air of distinction among its fellows--perhaps because it is so plentiful and always, so to speak, on view. It never or hardly ever goes to flowers or water. It flutters daintily about the rosy-vermillion flowers of *Ixora coccinea* by the sides of water-courses and the edges of paths in the half-shade of the jungles: or sits, expectant, on the end of a leaf in a patch of sunlight, basking with its wings half-open ; or flies about amongst the low bushes on business bent ; or rests, exposing the speckled glory of its underside, on the green foliage of some favoured shrub everywhere it exists. And it is limited in its range, for it is found only in Southern India and Ceylon, Assam and Orissa. The foodplants are various and the larva has been found on the following :—*Ixora*, *Hopea*, *Croton*, *Blachia*, *Loranthus*, *Schleichera*, *Eugenia*, *Careya* belonging to the families *Rubiaceæ*, *Dipterocarpeæ*, *Euphorbiaceæ Loranthaceæ*, *Sapindaceæ*, *Myrtaceæ*. It *might* be said to be fairly omnivorous in vegetables!

32. Genus—CATAPŒCILMA.

Three species of this genus are known from Indian limits, one only of which is wide-spread, namely, the one below, *elegans*. The three may be known by having three, short, thread-like tails to the hind wing like *Rathinda* and *Horaga*, but can be distinguished from both of them at once by the fact that the wings have sinuate outer margins and the underside is banded and spotted with metallic silvery-green or silvery violet instead of being marked with lines and spots as in the former, or with a broad-medial white band on a pure ground as in the latter; the wing neuration agrees very closely with that of *Horaga*, but the male never has any sexual characters such as are found in most of the species of that genus; the eyes are hairy, the antennæ have a gradually-formed, well-developed club; the palpi are moderately long, much compressed, the second joint reaching well beyond the head and longly haired beneath, the third slender, but well-formed. The transformations of *elegans* are known. The larva is normal, but depressed in shape with a large segment 2, the surface is covered with very minute, flat-topped, thick, circular, white tubercles. It is always attended by ants. The pupa is normal in shape and the last segment is not hoof-shaped as in *Rathinda*. Judging by *elegans*, the flight of insects of the genus is rather that of *Nacaduba* than anything else; fairly strong but of the fluttering description. *Catapœcilma* is an Oriental genus altogether and is known from Mussoori, Burma, South India and Ceylon.

186. Catapœcilma elegans, Druce. Male. *Upperside*: dull, dark purple with narrow, black, costal and outer borders which are inclined to be maculate; a fine anteciliary, black line; the *cilia* shining-grey and broadly black at the ends of the veins; the outside margin sinuate between the veins. Fore wing: the margins both narrow; a fringe of sparse, rather long, grey hairs along the inner margin. Hind wing: the costal margin above vein 7 and broadly, obliquely down to vein 6-end brown-black, outer margin as on fore wing; anal margin light-brown. *Underside*: dusky-smokey with a violet tint with light-yellow intervals along the costa of fore wing and lightest in middle of outer margin of the same, between the discal and subbasal markings of hind wing and along its outer margin, as also along the inner margin of fore wing below vein 1; with, on both wings, rusty and black spots and bands with broad margins of irridescent silver. Fore wing: above vein 12 on the costa many little, transverse, black lines with silver scales on them; in interspace 11: some silver scales about middle and a brown-quadrate spot in the end on the costa; in 10: two quadrate, silver spots, one in the middle and one before it and a brown one on the costa at its end; in 9: the same. In the cell: a rusty red spot with an outer, silver border filling the base; a similar one in the middle and another, quadrate, enclosing the discocellulars; both these last bordered on inside and outside with silver. Below the cell: a blackish, rounded spot in the angle of vein 2 and the median nervure, bounded outside by silver; the base of interspace 3 touching the discocellular spot, silver in continuation of the outer border of the borders of that spot, continued by a larger, quadrate spot filling the interval between veins 2 and 3 with a small spot in addition near its inside under vein 2; all chocolate dark-brown, the inner border of the whole silver; in interspaces 4, 5 in continuation of the outer border of this large mark is a continuous silver inside border to a chocolate-brown and dusky-brown mark; beyond all these is a postmedial, silver, broken, transverse band of lunules *en échelon* inwards from very near the costa to just below vein 2; a submarginal, transverse, perfect series of separated, quadrate, silver spots, six in number, from interspace 1 to costa; the margin beyond, narrow, very light, the *cilia* shining light ochreous with the ends broadly chocolate at the ends of the veins. Hind wing: the extreme bases of interspace 7, the cell and interspace 1*b* filled with, each, a chocolate-brown spot, outwardly bordered with silver; followed closely by a transverse row of three other, subbasal, similar spots in the middle of interspace 7, cell and 1*a*, some chocolate suffusion between in interspace 1*b* and above vein 8; a russet and brown band, margined with silver enclosing the discocellulars with a complete, transverse, discal band immediately after reaching from costa to vein 2, then sharply recurved to the middle of the inner margin, inside silver, rusty in the middle and bordered outside with diffuse chocolate, then a submarginal, nearly precisely similar, recurved band; a marginal series of silver, quadrate spots as on the fore-wing, margined with brown more or less; a fine, silver, anteciliary line followed by finer, brown line; the *cilia* as on fore wing. In interspace 2 the terminal markings are replaced by a black-centred blurred brown spot. Thread-like tails at the end of vein 1, vein 2 and vein 3, the middle one 4·5mm., the outer less than half that, the other shortest; all black with white tips. Antennæ light brown above, ochreous below, banded white; the club round, long, black, with orange tip. Palpi black above, ochreous below, with some silver scales on the sides. Head with the vertex and frons russet, the eyes rimmed silver. Thorax and abdomen dark brown, the former with blue hairs in front; below white; the legs very longly woolly.—Female. *Upperside*: pale azure-blue with broad, dark brown borders to the fore wing, the outer decreasing to the tornal angle where it comes to a point; it is quite 3 mm. broad at the apex, the broadest place; the inside edge is lunulated outwards between the veins. Hind wing: the costa broadly light brown above vein 6; the abdominal margin lighter brown; the outer margin narrower brown with a series of three blackish, blurred, terminal spots in interspaces 2, 1, 1*b*, 1*a*; all four bordered inside and out by silver lines. *Underside*: exactly as in the male but much lighter in shade. Expanse: male, 26-35 mm; female, 25-35 mm.

Larva.—The *shape* is more or less normal but somewhat broad and depressed-looking; the segments well-marked. *Head* completely hidden, shining light yellow in colour, dark red about the mandibles. Segment 2 large, semi-circular in shape, the hinder margin convexly curved backwards so as to encroach upon the length of segments 3, 4, with a dorsal, central, large, shining surface which is slightly convex (instead of flat as in most larvæ), the margins slightly thickened and turned up along the free edge; anal segments sloping, the last broadly and slightly squarely rounded, with a large, shining, slightly pitted, dark-brown depression dorsally-like that of segment 2: indeed segment 2 and the anal end are very like each other; hinder margin of segment 13 somewhat tumidly raised above this depression: the body between segment 2 and segment 12 parallel-sided, the last segment, perhaps, broadest; organs of segment 13 circular, black, not very easily seen; the gland of segment 12 conspicuous, transverse, triangular-depressed (the section, that is, is triangular). *Surface* of larva dull, each segment with a lateral transverse line at the lower end of which is the spiracle; covered with minute, flat-topped (disc-shaped), white, thick tubercles; some hairs round the free end of anal segment: no others anywhere along the dorsoventral margin. *Spiracles* small, black, circular, in the bottoms of the lateral, transverse folds. *Colour*: all the dorsal part of the body down to the lateral line is a dark, blackish green-brown in colour, marked lighter on each segment diagonally; the dorsal portion of segment 7 yellowish; below the lateral line the body is light greyish-green with dark mottlings arranged in a pattern showing two spiracular, olive-green, longitudinal lines which are slightly broken; free edges of segments 2 and 14 grey-green; ventrum yellow. L: 14 mm; B: 5 mm at segment 12; H: 5 mm.

Pupa.—The *shape* is quite normal. *Head* bowed, hidden under the large, convex, slightly dorsally carinated segment 2; segments distinct; thorax humped, convex, slightly compressed laterally on the dorsum; constriction behind thorax dorsally slight, laterally nil; abdomen circular in transverse section, rather long, ending in a perfectly rounded, more or less hemispherical shape with the last segment slightly turned under upon the ventral aspect of which are the suspensory hairs; lateral outline diverging ever so slightly from shoulders to segment 8/9 but very nearly parallel, pupa broadest at segment 9, of equal height at apex of thorax and segment 6/7; the general shape being long and narrow, curved down at both ends so that the pupa touches at both extremities and not elsewhere. *Surface* smooth, only slightly shining, very minutely haired all over. *Spiracles* of segment 2 facing forwards, nearly covered by a small expansion of the anterior margin of thorax; other spiracles raised, oval, black with a little hole in the centre—funnel shaped?—and conspicuous. *Colour* of the pupa is a nondescript yellowish dark-brown, smudged with black or very dark brown; otherwise, another way of putting it, yellowish-pink, speckled with black. L: 9 mm; B: 4 mm.

Habits.—The larva is always attended by ants of the genus *Cremastogaster* which never leave it either in that state or in the pupal state and it is often to be found in little houses built over scale-insects by them on the branches of the trees or on the twigs; it is restless, and difficult to keep in captivity. Three larvæ were found when originally discovered, in a dead leaf amongst foliage, hung up there and more or less fixed; they were huddled together. But the larvæ feed upon young, tender leaves, wandering out for that purpose, resting only on the undersides and eating all but the top cuticle. They wander off to pupate and rarely undergo the change on a green leaf; but generally choose a crevice or fold in a dead leaf, &c. The pupa is laxly attached by the tail only. There is no body-string. The growth of the larva is not particularly rapid and the pupa is somewhat long in producing the butterfly. The places the butterfly chooses to lay her eggs are generally in thick jungle on the low branches of a cut tree or small bush, not overshadowed by dense shade but exposed to the air and sunlight. The foodplant is *Terminalia paniculata* (*Combretaceæ*), a large tree. The butterfly is not often seen nor are its eggs and larvæ easy to find; indeed the eggs have so far eluded notice, notwithstanding seeking by the writer of this description. The male insect is, perhaps, even more uncommon than the female which is, at least, occasionally seen flying round the foodplants and laying eggs. They both stick to the jungles, the male occasionally basking low down on the end of a leaf. The flight is not strong but neither is it weak—a sort of medium fluttering style. It rests with its wings closed as a rule and never goes to flowers or water. It was first bred in Kanara District of Bombay and has been recorded from Masuri, Sikkim in the Himalayas; Orissa, South India; Kanara and the Nilgiris; Ceylon; Assam; Burma; the Malay Peninsula; Nias Island and Sumatra and Borneo.

33. Genus—Horaga.

Like the genus *Catapœcilma,* and the genus *Rathinda,* this is also distinguished from the majority by the insects having three tails to the hind wing; they are further characterized by having both wings crossed by a more or less broad, continuous, discal band whereas *Rathinda* is spotted with only an apical band to the hind wing, *Catapœcilma* is dark-banded and spotted without a sign of a similar white band. Eyes naked; body stout; palpi directed out straight in front, second joint roughly scaled, slender and reaching beyond the head, third joint cylindrical, one-third the length of the second; legs short, antennæ short, gradually thickened to the pointed club; considerably less than half the length of the wing. De Nicéville says that about ten species have been described, that the genus is a purely Oriental one, that its headquarters are in India and enumerates 7 species as occurring in India, Burma,and Ceylon of which, however, only 5 are now recognised as really good; others occur in the Malay Peninsula and some of the island of the Archipelago beyond. The flight of the insects is rapid, but they never go far, but settle again shortly. They do not go to flowers and water, at least they have never been observed to do so. The writer once saw many butterflies flying round the young shoots of *Diospyros embryopteris.* De Nicéville and Mackinnon bred two of the species at Masuri in the Himalayas and the larva is said to be very similar to that of *Rathinda amor* but has eleven processes instead of the 15 of that species. The pupa is stout, affixed only by the tail and evidently resembles very much the stout type of *Rathinda* chrysalis. The foodplant is given as *Coriaria nepalensis* of the family *Coriariaceæ.*

187. Horaga onyx, Moore.—Male. *Upperside* cyaneous-blue. Fore wing with a patch of white outside the end of the cell, divided into 4 by veins 2, 3 and 4; the upper piece the smallest, the spot below vein 4 small; the costa with a black band, narrow at the base, increasing in width outwards, occupying the whole apical space beyond the white patch, and broadly down the outer margin. Hind wing with the costal area broadly blackish, a narrow, macular, outer, marginal, black band; terminal black line; anteciliary bluish-white thread; tails black, tipped with white. *Cilia* of both wings black, tipped with white on the hind wing and at the hinder angle of the fore wing. *Underside* pale ferruginous-brown, with a pinkish tint. Fore wing with the hinder, marginal space below the submedian vein white; a broad band with dark-brown edges crossing the wing from the white hinder space to near the costa, its inner edge passing just outside the end of the cell, fairly erect, somewhat sinuous, its outer margin inwardly oblique from vein 4, narrowing the upper end of the band to a point below the costa; terminal line dark-brown. Hind wing with a narrower band in continuation, edged inwardly with dark-brown, somewhat diffuse on its outer side, the band somewhat constricted in its middle, extending from the costa (where it is broadest) down to the first interspace, where it is angled and runs inwards in a straight black line, with some metallic blue-green spots on it; two similar spots below the angle; and three or four on the abdominal margin above the anal angle; a black, anal spot in interspaces

1 and 2, each with a metallic blue-green spot attached to it; marginal line dark brown, a white thread inside it. *Cilia* of both wings white, containing a medial, brown line. Antennæ black, ringed with white; head and body above and below concolorous with the wings, abdomen whitish beneath and at the sides.—Female. *Upperside* paler and duller blue, the discal white patch on the fore wing larger, more complete and usually oval-shaped. *Underside* as in the male but paler, and the white bands broader. Expanse of wings, 28-34 mm.

Larva.—" Of the usual lycænid shape, furnished with eleven tentacular processes; two on segment 3; a single one on segment 4; 3 on segment 5; 1 each on segments 6-9; 2 on segment 11; those on segments 3, 4, 7-9 all dorsal; one of 5 dorsal, two lateral; the two on 11 lateral. Colour being green in some places, brown in others." (*Mackinnon* and *de Nicéville*).

Pupa.—" Very short and thick for its length, with no medial girth. Colour light green anteriorly, the wing-cases brown; the abdominal segments also brown; green on the back of the body." (*Mackinnon* and *de Nicéville.*)

Habits.—The butterfly has much the habits of *Rathinda amor* but is, perhaps, rather stronger on the wing; it flutters in much the same way and sits on leaves. It does not come to flowers or go to water and never comes into the open. It is a jungle species but is found on the sea coast at sea-level in Kanara as well as in the scrub-evergeen parts above the Ghats at 2,500′. It is most decidedly rare in Kanara below the Ghats though more plentiful above. It has been recorded from the Himalayas; the Karen and Shan Hills; Sikkim and the Khasis; Assam; Orissa; Kanara in Bombay. The foodplant is given as *Coriaria nepalensis* by Mackinnon and de Nicéville.

188. Horaga cingalensis, Moore.—Male. *Upperside* of a brighter and cleaner blue than in *H. onyx*. Fore wing: the outer margin more convex; the white patch usually smaller, not usually extending below vein 2; the black, outer, marginal border narrowing hindwards. Hind wing: with the upper tail (at the end of vein 3) in all the specimens we have seen, very short, not half as long as it is in *onyx*. *Underside*: ground colour similar. Fore wing: with the margins of the white band more even, making the band somewhat bottle shaped. Hindwing: the band narrower, straighter, not constricted at its middle; the anal markings somewhat similar, but the space between the anal, black spot and the black spot in the first interspace is white speckled with black atoms; there is an extra subterminal, small, black spot in the third interspace and each spot and mark in each interspace is capped with metallic blue-green scales. Antennæ, head and body as in *onyx*.—Female. *Upperside*: dull bluish-grey. Fore wing: with some blue scales on the basal portion; the white patch as in *H. onyx*. Hind wing with some white on the middle of the costa and a small, suffused, whitish space in the middle of the wing; the ground colour of the wing paler than it is on the fore wing. *Underside*: as in the male, Expanse: male 28 mm; female, 30 mm.

Habits.—The transformations are unknown and the habits, practically, also.

Habitat.—South India, Ceylon. The Type came from Ceylon; it is found also in Kanara; it is closely allied to *H. onyx*, but can always be recognised by the shortness of the tail at the end of vein 3. (*Swinhoe*).

188 a. Horaga viola.—Male. *Upperside*: blackish-brown with a slight violet tint. Fore wing with a somewhat oval white patch outside the cell, varying in size in different examples. Hind wing without markings, tails black, tipped with white, outer marginal line of both wings finely black. *Underside* paler with a stronger violet tint. Fore wing: with the white patch continued to the hinder margin, somewhat constricted at the submedian vein. Hind wing: with a black, anal spot; another usually (but not always) in the first interspace; and some obscure blackish spots in the others. Antennæ black, ringed with white; head and body above and below concolorous with the wings; no sex mark in the male. Female. *Upperside*: dull greyish-blue. Fore wing: with the white patch larger than it is in the male; costal black band rather broad, widening gradually from the base to the apex, filling up the whole apical space outside the white patch and broad down the outer margin to the hinder angle. Hind wing: with the costal space broadly blackish, with a small white patch on the middle of the costa; the outer margin with a narrow, more or less macular, black band; marginal line finely deep black, with an inner, white thread. *Underside* as in the male. Expanse: male, 22 mm.; female, 25 mm.

Larva.—A single specimen from a larva found feeding in Mussuri on the leaves of the *Coriaria nepalensis.* It is a most curious-looking creature, about half an inch long, of a reddish-brown colour, of the usual lycænid shape, but furnished with eleven tentacular processes, two on the third segment, one each on the fourth, seventh, eighth, and ninth segments, all dorsal, the fifth has three, two lateral and one dorsal, the eleventh has two lateral ones. (*Mackinnon* and *de Nicéville*). Habitat.—India. The type came from Dharmasala, N. W. Himalayas; Mackinnon and de Nicéville record it from Mussuri and Sikkim; Colonel Swinhœ has it from Nilgiris, 3,500 feet elevation and says: "it is a rare species, though widely distributed." It has also been taken in Kanara, Bombay Presidency.

34. Genus—LOXURA.

"Eyes naked, body short, only moderately robust; palpi long (still longer in the female), flattened and scaled throughout, second joint outreaching the head by two-thirds its length, third joint half its length; legs short, thick and scaled; antennæ short, only one-third the length of the costa, thickened throughout their length." (*Moore*, as quoted by *de Nicéville*).

De Nicéville says that "four species of the genus have been recorded from India. I am unable to give a single character by which these species can be identified...... They are very conspicuous butterflies on the wing and are usually found amongst trees and bushes, especially bamboos. They have rather a weak flight and their long tails soon get broken." At the present day these forms have all been placed under the single name *atymnus* as separate races characterizing different regions in India; Ceylon; the Andamans; South India; and North India, Burma and the Nicobars. They are all, however, represented in Kanara District of Bombay; so they do not even merit to be considered as races. The butterfly also inhabits, outside India, the Malay Peninsula and some of the Malay Islands. The larva and pupa are somewhat abnormal in shape, the former having a waist and being shining as to surface, the latter having only the tail attachment and the last segment hoof-shaped. The foodplant is *Smilax* or *Dioscorea*, only the young shoots being eaten; the former belonging to the *Liliaceae*, the other next door to it.

189. Loxura atymnus, Cramer.—Male. *Upperside*: both wings tawny-golden, the intensity of the tint varying in individuals, from florid but not glossy-orange to pale saffron-yellow. Fore wing: the exterior and posterior margins blackish brown, the inside boundary being regular and passing in an arch from the middle of the costa to the tornal or outer angle, leaving the greatest breadth at apex. Hind wing with a narrower and paler, apical border, the inner edge of which is slightly dentate and gradually diffused into the ground-colour of the surface or entirely covered with a diluted yellowish tint; inner margin dirty-greyish and downy, lengthened in the direction of the lobe; the lobe irrorated with dusky-white. *Underside*: both wings covered with a yellow-ochreous, powdery tint which is uniformly diffused over the whole surface; marked with four brownish. parallel bands, the two inner ones of which are generally very obsolete and apparent only in fresh and well conditioned specimens; the third, extending across the middle of both wings, is the most distinct and is composed of darkish lunules between the veins all continuous with each other; the fourth, marginal, is faint and interrupted. Hind wing: the transverse or lower end of the lobe is marked with a brownish streak consisting of three confluent spots which are covered along the margin with whitish irrorations, the inner spot being diffused over the rounded extremity of the lobe. Body brownish above with a slight admixture of yellow; the thorax with delicate, silky heirs; underneath, these parts are covered with a short, close, whitish down. Antennæ brown. Tail pale tawny with an obscure margin and a white tip.—Female: exactly like the male and can be distinguished by the conformation of the front legs; the tarsi also by the wing being broader, the costa more arched, the inner margin longer than in the male; thus giving the wing a blunter appearance.

The above description is taken from de Nicéville's book and is Horsfield's original one. Expanse: male, female, 30-45 mm.

The four species mentioned by de Nicéville are *atymnus, surya, prabha* and *arcuata*. The first is given as occurring throughout India; the second as coming from Kanara and Travancore; the third from the South Andamans; the fourth from Ceylon. In Kanara the form *atymnus* is common; *surya* is the dry-weather form of it and all of them are now allowed to be one species; there is no doubt that they are. The name *atymnus* is Cramer's and dates from 1780 and is far the earliest. The others are all Moore's; he was very fond of making species.

Egg.—The *shape* is hemispherical or very nearly so and it is broadest at the very base. The *surface* is shining, like china, pitted rather minutely all over, with a rather deep, apical, much larger pit—the miscropyle. The *colour* is white. B: 1mm.

Larva.—The *shape* is, on the whole, that of *Tajuria cippus* though the "waist" is less developed, the segments 11, 12 are not broadened out laterally and the front part about segment 5 is not so much broader than the rest of the body as in that species; on the whole the shape is narrow for the length, being more or less of the same breadth from segment 3 to segment 11 except for the slight narrowing of the waist about segment 9. The *head* is hidden by segment 2 and is rather small, shining yellow and round; segment 2 is not very broad, somewhat thickened round the free margin with a slight emargination in the dorsal line on the front margin, more or less hemispherical in outline, the dorsal slope towards segment 3 slight; segment 3 ascending more rapidly and segment 4 still rising at the same angle to the top of 5 which is the highest point of the body; after which the dorsal line descends again very gradually and very slightly concavely about segment 9, where the waist is, to the anal end which is the lowest as well as the narrowest place; this anal end is flattened dorsally and is square at the extremity round which there is a distinctly thickened flange—as, indeed, there is to a somewhat lesser degree, round the whole body on the dorsoventral line; here, also, as in the larva of *Tajuria cippus* the dorsal portion of segments 3 and 4 is flattened. *Surface* of larva is pitted minutely and rather deeply all over, also finely corrugated into the bargain and clothed with minute, white tubercles; otherwise shining and quite naked. *Spiracles* are situated in depressions, raised in themselves, circular in shape and white in colour. The *colour* of the larva is greenish-yellow, rather soiled, suffused with dull rose on the sides of segment 2 and segment 14 ; ventrum dull rose. The colour may be more green than rose or more rose than green. The thickened dorsoventral flange is deeply indented on its ventral surface. L : 19 mm ; B: 4·5 mm.

Pupa.—Has, at first sight, the appearance of being normal in *shape*, but the anal end is hoof-shaped though not very prominently so ; and there is only the tail attachment (the shape and style is very like those of *Cheritra jaffra*) ; the *head* is hidden under segment 2 ; segment 2 is semi-circular in front, very convex transversely, the dorsal line in the same plane as the front slope of the thorax although the front margin is rather minutely suddenly higher than the posterior margin of segment 2 ; thorax convex-humped, slightly carinated in the dorsal line ; the constriction is slight ; the pupa is broadest at segments 3 (shoulders) to segment 6, highest at the thoracic apex although the height at segment 6 is nearly as great ; transverse section of the abdomen is all but circular ; the anal segment is horse-hoof-shaped ; and the ventral portions of segments 12-14 lie flat on the attachment surface. *Surface* slightly shining, slightly minutely roughened, quite naked, rugose on the dorsal abdominal band. *Spiracles* of segment 2 oval, dull enamel-white, convex, of ordinary size ; others longly oval, white, on raised green broadly oval swellings *Colour* of pupa green ; margins of segments 3-5 along the wing-lines lined with black ; front and back of thorax suffused black ; dorsum of abdomen greyish-brown with the sides by the wings tinged with rose-colour ; wings suffused blackish outwardly. L : 15mm ; B : 4mm ; H : 4·5mm.

Habits.—The eggs are laid on the young shoots that spring out of the ground to the height of several feet before any leaves develop ; also on the leaf-buds later on before the leaves expand ; one at a time though there may be several on the same shoot. The larvæ resemble, in the most astonishingly accurate manner, the leaf-buds at the nodes of the shoots and thus escape notice as they take advantage of that resemblance and lie closely applied *along* the shoots. The pupa is formed also along the stem with only the tail-attachment closely applied along ventrum. The caterpillar is invariably attended by ants, the red, biting species with pugnacious, aggressive habits, *Œcophylla smaragdina.* The pupa less so. When the caterpillar is violently disturbed it hardens itself and becomes rigid and falls, though, as a rule, it is very firmly seated and is not easily shaken off. The butterfly haunts the underwood in the jungles and does not venture into the open except for very short distances at a time and then only, when in transit from one jungle to another or one bit of jungle to another. It keeps mostly low down and does not fly high. It is generally seen about the foodplants especially at the beginning of the rains and end of the hot weather in Kanara when the shoots of *Smilax* the foodplant are coming up everywhere from the roots that have lain practically dormant during the months of January to May. It has rather a strong flight, somewhat "jigging," in triangular curves and never flies far; it alights on the shoots of the footplant or on bare twigs and sticks, and sits with the wings closed, the little white tips to the long tails waving in the wind. It walks about also sometimes when settled and is not very quick at rising. It basks low down, too, in the sun, with the wings opened about a quarter. In Kanara they are found from sea-level up to 2,500′ but always in jungle and they prefer the neighbourhood of the evergreens to the opener deciduous type—the places where *Smilax* abounds; they have no other food except *Dioscorea* which is, practically, the same thing. The distribution has been given above under the genus but is repeated here, taking it as a fact that only a single variable species exists:—throughout India, Ceylon, the Andamans and Nicobars, Burma, and throughout the Malay Peninsula and Islands.

The figure of the butterfly on Plate H, numbered 55 is, on the whole, rather good except that the tail-points are not black and white enough and the underside not bright enough.

35. Genus DEUDORIX.

The eyes are hairy; the body robust; the palpi straight, the second joint reaching beyond the head by one-third its length, and thinning upwards, smoothly scaled, the third joint very slender about one-fourth the second in the male, longer in the female; legs scaly, femora haired below; antennæ longer than half the costa, club evenly-formed. *Deudorix epijarbas* is the type species and the one that is dealt with here. In all its ways it is very closely allied to *Virachola* and has nothing to do at all with *Rapala*. The shape of the wings, the style of marking on the underside, the larva and its habit of feeding on the interior of fruits, the pupæ—all are those of *Virachola*. The larvæ of this, *Virachola* and *Bindahara* are extremely like each other and rather difficult to separate. There are supposed, at the present day, to be four species of *Deudorix* in the Indian region. The genus exists in every part of India except in the desert tracts and very high altitudes; in Ceylon, the Andamans and Nicobars; Burma, Malay Peninsula and across to Celebes. Indeed that is the distribution of the single species *epijarbas*.

190. Deudorix epijarbas, Moore.—Male. *Upperside*: scarlet-red in colour. Fore wing: with broad black, costal and outer marginal borders; the costal band has its inner margin somewhat curved, being limited by the median vein, consequently it is broadest at the apex, its inner edge on the outer margin is uneven, and at the hinder angle the black band is continued for a short distance along the hinder margin; the rest of the hinder margin is narrowly suffused with black, and so is the submedian vein. Hind wing: with the costa, base and abdominal area suffused with blackish, the abdominal fold brown; outer marginal line finely black; anal lobe black with a small, red mark in it; tail black, tipped with white, the veins often more or less finely black. Antennæ black, ringed with white; club with a red tip and with a white streak on the underside below it. *Underside*: greyish-brown, markings indicated by their white edges. Fore wing: with a thick bar, with a pale-white line splitting it at the end of the cell; a discal, almost straight, rather broad band narrowing gradually hindwards; a submarginal series of thick, lunular marks, edged outwardly with white, its lower end close to the lower end of the discal band. Hind wing: with a thick bar, with a pale-white line running through it, at the end of the cell; a discal series of seven conjoined spots;

the upper six squarish, the seventh angled, the series irregular, the second spot a little outwards, the fifth a little inwards touching the lower end of the spot of the discoidal band and decreasing in size hindwards ; the angular spot running in on to the abdominal margin one-third above the anal angle, a submarginal series of similar spots, increasing in size hindwards ; anal lobe black ; a linear white mark, and a curved streak of metallic-blue scales above it; a black spot in the first interspace, ringed with orange.—Female. *Upperside* : fulvous-brown. Fore wing : with some fulvous suffusion below the median vein, varying in extent in different examples. Hind wing with the abdominal fold pale, in some examples without any markings, in some the entire wing is tinted with fulvous ; and sometimes there are indications of a series of fulvous, submarginal spots. *Underside* as in the male, the ground colour often much paler. Expanse ; male, 35 to 48 mm ; female, 32-50 mm.

Egg.—Depressed—hemispherical, broadest just above base, with a central, apical depression ; 14 rows of more or less square, fine-walled cells from the top to base with a small prominent point at each wall-intersection ; walls fine, subregular, nearly all meeting in the apical depression ; *colour* white, shining. B : O. 5mm ; H : O. 25mm.

Larva.—The general *shape* of the body is, perhaps, the normal lycænid form but tapering more than usual to the end, the transverse section being convex over dorsum, flat on the ventrum, the fore-end semicircularly rounded, the anal end which, composed of segments 12-14, is an elongated semi-circle in outline with a strong dorsal slope, thickened round the edges, the whole dorsal part inside being a flat, circular surface formed into a sort of flat disc to fit the hole which the larva makes in the rind of the fruit: it is admirably constituted to clean out the refuse from inside—for which purpose it is actually used ; *Head* shining red-brown ; eyes black ; clypeus round-topped triangular, slightly sunk at apex, half the height of the head, with a thin, whitish border-line continued up on to the vertex of head as the dorsal line ; labrum and basal, antennal joint dirty-white ; ligula and second joint dirty-orange ; the ligula large with a shallow. frontal sinus, segment 2 is semicircular, also tumid round the margin, the dorsum being occupied by a large triangular depression with the sides curved, the base along the hinder margin and shining at the bottom but not very deep ; the whole slightly ascending towards segment 3 from the front margin ; segment 3 is a good deal broader and higher than segment 2; segment 4 than 3 ; segments 5, 6 are the broadest and highest part of the body ; it thence decreases both in breadth and height to segment 10 ; segment 11 is somewhat narrower and lower than 10 and flattened dorsally with the transverse, mouth-shaped gland at its hinder margin; segments 12-14 are dorsally indistinguishable from each-other, composing the "shovel" and the organs are situated on this flat, circular shovel as well as the last pair of spiracles, and the protrusible bodies are white and cylindrical. *Surface* of body shining and oiled-looking, covered densely with small, moderately short, erect, blackish bristles ; round the dorsoventral margin and round the shovel, as well as along the front margin of segments 2 and 3, is a row of long, erect, lightish hairs three or four times as long as the bristles 7 or 8 to each segment ; each segment from 4-10 has a dorsal and lateral, transverse depression, the spiracles being situated in the bottoms of the end of the lateral ones. *Spiracles* are conspicuous, large, oval, light yellow—the lateral depressions are fairly broad. *Colour* is dirty leaden-green, segment 2 and segment 3 yellow ; segments 4, 5, and 10 are a dirty brown-green, segments 7-8 dorsally pale-orange except for a dorsal, central small patch of ground colour and a subspiracular white patch ; the centre of the "shovel" is also dirty brown-green. L : 16mm ; B : 6·25mm ; H : 4·75mm.

Pupa.—Very much the same *shape* as that of *Virachola perse.*, *i. e.*, the usual normal, lycænid shape: very little humped in the thorax, constriction behind it very slight dorsally, nil laterally, the lateral outlines parallel from shoulders to end of wings, shoulders very little prominent: *head* hidden under segment 2; segment 2 with the outline semicircular in front, convex transversely, the dorsal slope of ascent from front margin the same as that of the front of thorax; the pupa is stoutest about segment 8, though very little stouter there than at the shoulders. The *surface* covered with minute, erect hairs; round the front margin of segment 2 and round the spiracles and along the body just at the dorsal margin of wings are some longer, light, hairs, erect and otherwise. *Spiracles* of segment 2 facing forwards, oval, whitish; the rest situated in wide depressions, fairly large and conspicuous, oval and a little lighter in colour than the rest of the body. *Colour* of pupa is rosy-brown, covered with blackish spots and smudges, forming on the abdomen a dorsal line, on the thorax a lateral crescent above each shoulder; the dorsum of thorax and front slope lighter. L: 11 mm: B: 5·5 mm.

Habits.—Single eggs are laid on the stalks, leaves and flower-buds, also on the stems of the branches, twigs, &c. The little larva makes its way immediately to the fruit and bores its way through the shell into the inside; it eats the inside, changing, as necessary, as it grows, to another fruit. It often pupates inside the fruit it last cleans out. De Nicéville says in his description that the colour is "dull-ochreous blotched with leaden-black, the surface of all the segments smooth and shining, the constrictions between the segments well-marked, each segment with a shallow, dorsal pit, a subdorsal and a lateral pit which bears the *deep-black* spiracles; the entire lateral" (dorsoventral evidently) "edge of the larva furnished with rather long, bristly hairs." The spiracles *may* be black in some specimens though, generally, their colour is very constant and characteristic. He also remarks that the butterfly "has an extremely rapid flight, but often settles and is not easily caught" which is very true. The insect is of wide range and is found in the plains and the hills, in regions of heavy rainfall as well as where it is anything above 10″ or 15″, in open land as well as in the forests, from sea-level up to, certainly, 4,000′ for it has been taken at Masuri in the Himalayas. Both the male and the female go freely to flowers and also, occasionally, to water in damp places on the ground; the male may be caught basking on quite high trees with the wings somewhat less than half-open; but they rest with them closed. They may both be taken at flowers quite easily but, once on the wing, the flight is too rapid and irregular to make a capture anything but difficult. *Epijarbas* is recorded from all throughout India except in the desert tracts and very high elevations; Ceylon, Andamans, Nicobars, Burma, Malay Peninsula, Nias, Borneo, Celebes. The larva is rarely attended by ants. The foodplants are the fruits of Pomegranate, *Sapindus trifoliatus* or Rita, *Connarus*, and probably others.

SOME BIRDS OBSERVED AT FAGOO, NEAR SIMLA.

BY

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While on a short spell of casual leave in Simla this year [1918], I seized an opportunity of going out to Fagoo in hopes of obtaining some birds new to my collection. Fagoo is the name of a stage 14 miles from Simla on the main Hindustan-Tibet road; the Dak Bungalow there is situated at a height of 8,200 ft. But the ridge behind the Bungalow rises somewhat higher.

The name of Fagoo will be familiar to students of the earlier records of Indian ornithology, as both Beavan and Tytler obtained some specimens there, and the locality also is mentioned in some of Hume's notes.

I reached Fagoo on 25th October and returned from there again to Simla on 31st October; during this period a heavy storm occurred and fresh snow fell on some of the hills further north. At Fagoo there was hoar frost every night, which remained all day in sheltered patches. It will be seen from the notes below that many of the birds from the higher Himalayas had already arrived.

The country round Fagoo is on the whole disappointing; with the exception of small protected forests, the hillsides are somewhat bare, consisting of rough cultivation and bush scrub, divided here and there by small patches of oak or pine wood.

1. The Jungle Crow—*Corvus macrorhynchus levaillanti,* Less.

Abundant and generally distributed.

2. The Himalayan Nut-cracker—*Nucifraga caryocatactes hemispila,* Vig.

Two pairs were seen and another one or two heard in the woods about Fagoo between 7,500 and 8,500 ft. The curious harsh call carries a long way in the nullahs and reveals the presence of birds which otherwise escape notice. One pair observed feeding, were busily engaged in searching the needle clusters of a *Pinus longifolia.* Although not ordinarily shy, their suspicion is easily aroused and it is not then easy to secure a specimen.

3. The Indian Grey Tit—*Parus atriceps,* Horsf.

A few observed about Kasumpti (6,500 ft.) and at Fagoo.

4. The Green-backed Tit—*Parus monticolus monticolus,* Vig.

Very common and noisy and one of the most conspicuous members of all hunting parties.

5. The Crested Black Tit—*Parus melanolophus,* Vig.

Very common and found in all hunting parties; the long crest is carried erect and with the pure white cheek and nape patches gives the bird a very distinctive appearance.

6. The Red-headed Tit—*Aegithalos erythrocephalus erythrocephalus,*(Vig).

Several flocks of this beautiful little tit were met with, in every instance forming part of a larger mixed hunting party.

7. The White-throated Laughing Thrush—*Garrulax albogularis,* Gould.

Two small flocks were met with in some heavy jungle at about 7,500 ft. when I was beating for Pheasants. They were very shy and moved quickly through the forest uttering their weird cries. This is the first occasion on which I have come across this species although I have always been on the look out for it when in the Hills. It would seem to be very local and capricious in its distribution.

8. The Red-headed Laughing Thrush—*Trochalopteron erythrocephalum erythrocephalum,* Vig.

A single individual was observed in the open in a small patch of stunted trees, where it was uttering a loud and beautiful call.

9. The Variegated Laughing Thrush—*Trochalopteron variegatum variegatum,* (Vig).

Very common and easily found from its noisy behaviour. Individual bands appear to move about a good deal up and down the hillsides in the course of the day so that a patch of jungle may be found full of them at one time and at another time empty. They also move freely out into the trees on the open cultivated hill-sides.

10. The Streaked Laughing Thrush—*Trochalopteron lineatum grisescentior,* Hart.

Less abundant than the last species and for the most part found skulking close to the ground in low bushes in or about the terraced cultivation.

11. The Rusty-cheeked Scimitar billed Babbler—*Pomatorhinus erythrogenys erythrogenys,* Vig.

A single individual was seen and shot while we were beating out a small strip of wood between two fields on a hillside about 7,500 feet. It came flying along low over the ground with a rather peculiar flight and appearance due to the short wings combined with the heavy bill and tail.

12. The Black-headed Sibia—*Lioptila capistrata pallida,* Hartert.

Not observed at Fagoo though it was seen in Simla at a little over 7,000 feet on Jacko.

13. The Stripe-throated Siva—*Siva strigula strigula,* Hodgs.

A flock of these handsome little birds were observed feeding in some bushes in heavy jungle above 8,200 feet near the Dak Bungalow; the yellow of their plumage blended extraordinarily well with the dead leaves on the bushes, and their whole actions and subdued call-notes were very reminiscent of the family of Babblers, especially when alarmed by my presence, the flock began to move rapidly up the hill. They went so fast feeding through the jungle that I lost contact, but afterwards I found the flock again at its leisure in some seedling firs in a warm sunny hollow on the top of the hill. Here they were unsuspicious and allowed a near approach.

14. The Black Bulbul—*Hypsipetes psaroides,* Vigors.

A couple of flocks were observed in a nullah to the south side of the ridge on which stands the State Rest house at Fagoo, somewhat below 8,000 feet.

15. The White-cheeked Bulbul—*Pycnonotus leucogenys,* (Grey).

A few were observed up to 8,000 feet in the nullah mentioned under the last species.

16. The Himalayan Tree-Creeper—*Certhia himalayana himalayana,* Vig.

One or two individuals were observed in company with hunting parties.

17. The Cashmere Wren—*Troglodytes troglodytes neglectus,* Brooks.

Observed on three occasions only; one bird was feeding in the terraced hedge, separating two fields from one another; the second was skulking in the bushes of an isolated patch of open jungle, and the third was found in heavy jungle in company with a hunting party. The note is a harsh "chipping" one, similar to that of the English wren in character but louder and deeper in tone.

18. The Himalayan Gold Crest—*Regulus regulus himalayensis*, Jerd.

Two specimens were obtained from a hunting party on the last day of my trip; I had not previously realised that the species was likely to be about, so it is probable that many of the small birds which I had previously attributed to *Phylloscopus proregulus* were in reality of this species; both birds appear very similar in the field.

19. The Siberian Chiff-chaff—*Phylloscopus collybita tristis*, Blyth.

Common and generally distributed about Fagoo, both in forest and in bushes about cultivation. It appeared to be averse to the company of hunting parties and to be usually solitary or in company only with one or two individuals of its own species. The loud single note was frequently heard.

20. Pallas' Willow Warbler—*Phylloscopus proregulus newtoni*, Gatke.

I believe that this willow warbler was common in the hunting parties but unfortunately did not obtain a single specimen for verification.

21. Hume's Willow Warbler—*Phylloscopus superciliosus humii* (Brooks).

This species was heard calling freely in and about Simla from 6,500 to 7,500 feet, but appeared to be very much less numerous at Fagoo.

22. Hodgson's Grey-headed Fly-catcher Warbler—*Cryptolopha xanthoschistos xanthoschistos* (Gray).

One or two were met with in hunting parties.

23. The Pale Bush Warbler—*Horeites pallidus*, Brooks.

A single specimen was shot skulking in the base of a low bush amongst mixed cultivation and scrub on a steep hillside. It was uttering a harsh chucking note similar to that of *Phylloscopus indicus*. In the same area I failed to secure what was probably a second specimen of the same species. On several occasions about 7,000 feet in Simla I heard a song attributed to this species.

24. The Brown Hill Warbler—*Suya crinigera*, Hodgson.

A specimen was presented to me by a small sportsman with a pellet bow, who must have obtained it close to the Dak Bungalow at Fagoo. Personally I only met with the species at about 6,500 feet at Kasumpti, close to Simla, but it is doubtless common in all the cultivated valleys.

25. The Short-billed Minivet—*Pericrocotus brevirostris* (Vigors).

Abundant in flocks which moved freely up and down the hillsides over forest and cultivation alike, but of course, only settling in trees.

26. The Common Mynah—*Acridotheres tristis* (Linn.).

Several in Fagoo bazaar at 8,200 feet.

27. The Grey-headed Flycatcher—*Culicicapa ceylonensis*, (Swains).

Although no individual was actually seen I heard what was almost certainly the call of this Flycatcher at about 7,800 feet in a nullah.

28. The Yellow-bellied Flycatcher—*Chelidorhynx hypoxantha*, (Blyth).

A small party of these beautiful flycatchers was observed in some heavy jungle above 8,000 feet. They happened to meet with a hunting party and the *Phylloscopi* in the latter took exception to their presence and several graceful ærial combats took place.

29. The White-capped Redstart—*Chaimarrornis leucocephala* (Vigors).

One was seen frequenting a stream at about 7,500 feet near Cheog Village.

30. The Blue-fronted Redstart—*Phœnicurus frontalis*, Vigors.

Three of these Redstarts, all females, were met with, in each case frequenting small patches of bush with a few trees on fairly open hillsides. They were very tame and allowed a close approach ; the conspicuously marked tail renders the species very easy of identification in the field.

31. The Blue-headed Redstart—*Phœnicurus cæruleocephala*, Vigors.

A female was found in company with one of those of the last species. A male flew past me on a hillside just above Kufri Bazaar (8,000 ft.) on the return journey.

32. The Golden Bush Robin—*Tarsiger chrysæus*, Hodgson.

I shot a small bird which was sitting in one of the terrace hedges on a partly cultivated hedgeside under the impression that I was firing at an accentor, but on picking it up was pleasantly surprised to find that I had secured an adult female of this somewhat scarce species.

33. The Whistling Thrush—*Myiophoneus temminckii temminckii*, Vigors.

This was one of the common birds of the hillsides occurring in all the more open woods. Apart from its predilection for mountain streams and the ravines through which they run, it is a very arboreal species and trees rather than undergrowth are essential for its comfort.

34. Jerdon's Accentor—*Prunella strophiatus jerdoni* (Brooks).

Very common but from its skulking and shy habits rather difficult to secure without risk of damage to the skin. This accentor was usually met with singly, threading the undergrowth in any open locality whether close to thick jungle or amongst cultivation. When flushed it would fly but a short way and then abruptly settle again at the base of some patch of cover. The note is loud and rather harsh, but reminiscent of that of the English Hedge-Sparrow.

35. The Black-throated Accentor—*Prunella atrogularis* (Brand).

A small flock of these Accentors were frequenting a certain patch of hillside where some small fields were packed in between scrub jungle and a small but very thick Ilex wood. They were even greater skulkers than the last species and, in spite of several attempts, I failed to get a shot, although on one or two occasions I could see individuals in the open within 2 or 3 yards of me which had to be spared.

36. The Himalayan Green finch—*Acanthis spinoides* (Vigors).

In the course of a hurried visit of one day to Kufri at the end of August I had found the Himalayan Green finch extremely common in the cultivated stretches of hillside that border the roadside, but on this trip I found that the species had practically vanished. There were one or two still about close to Fagoo bazaar and these had probably been detained by late nesting.

37. The Common House Sparrow—*Passer domesticus indica*, Jard. and Selby.

A few observed about the State Rest House at Fagoo.

38. The Cinnamon Sparrow—*Passer rutilans debilis*, Hartert.

Not uncommon at Fagoo in a patch of light jungle close to the Dak Bungalow.

39. Stolickza's Mountain Finch—*Montifringilla nemoricola altaica*, (Eversm).

On the return journey just above Kufri Bazaar I came across a huge flock of some 50 to 80 flinches which were new to me.

They were perching in the tall scrub which bordered the sides of the terraced fields, and when disturbed flew backward and forward calling, loath to settle, but equally loath to depart. I was very hard up for time, but with some trouble luckily secured one specimen which proved to be of this species. The crop was full of minute seeds.

40. The Grey-headed Bunting—*Emberiza fucata arcuata*, Sharpe.

A single immature specimen in heavy moult was shot in a low bush on a partially cultivated hillside.

41. The Eastern Meadow Bunting—*Emberiza cia stracheyi*, Moore.

The Meadow-Bunting was without doubt the most common bird in the neighbourhood of Fagoo, found every where except actually in thick jungle. Wherever one went its squeaking note would be heard on the ground and one was continually disturbing small parties which rose with a flash of their white tail feathers only to settle a few yards further on. The presence of a party thus moving in front often made it difficult to get a chance at some more desired specimen. They feed mostly on the ground or in bushes, but are not averse to perching in trees.

42. The Crag Martin—*Riparia rupestris* (Scop).

The Crag Martin was general in small numbers about the road from Jacko to Fagoo, hawking backwards and forwards at a moderate height along the hillsides.

43. The Upland Pipit—*Oreocorys sylvanus*, (Hodgs.).

A single individual was found feeding in heavy grass on a cultivated hillside beyond Kasumpti, (6,500 feet); it was not at all shy, but kept on rising at my feet with bunting like flight and settling but a short distance away, when it would again commence to feed rapidly along the ground.

44. The Brown-fronted Pied Woodpecker—*Dryobates auriceps*, (Vig.).

Observed at 7,000 feet in Chota Simla. Woodpeckers appeared to be scarce at Fagoo as I saw none and heard only one or two calls of species not identified

45. The King Vulture—*Otogyps calvus*, (Scop.).

Seen at 7,000 feet near Chota Simla.

46. The Himalayan Griffon Vulture—*Gyps fulvus himalayensis*, Hume.

A large vulture which I attributed to this species was common soaring over the hills at Fagoo.

47. The White-backed Vulture—*Pseudogyps bengalensis* (Gmel.).

A few observed about 7,000 feet at Simla.

48. The Egyptian Vulture—*Neophron percnopterus*.

Not observed at Fagoo and only one or two seen with the kites about Simla. The exact race represented was not ascertained.

49. The Lammergaier—*Gypætus barbatus grandis*, Storr.

This grand bird was to be seen sailing over the hillsides or sweeping high over the valleys at almost any time both in Simla and about Fagoo; adult and immature birds appeared to be equally common. It is not shy and on one occasion I might almost have killed one on the wing with my small collecting gun.

50. The Short-toed Eagle—*Circaëtus gallicus* (Gmel.).

One was seen hovering high over the ridge on which stands Fagoo dak bungalow. Mr. A. E. Jones informs me by letter that he observed one in the same place in September.

51. The Pariah Kite—*Milvus govinda*, Sykes.

Kites were scarce at Fagoo, but the one or two that I saw appeared to belong to this species, which swarms about the bazaar in Simla.

52. The Sparrow Hawk—*Accipiter nisus*, (L.),

Not uncommon about Fagoo.

53. The Shahin Falcon—*Falco peregrinus peregrinator*, Sundev.

On one occasion when I was collecting on an open hillside a Falcon, apparently of this species, stooped at a small bird that I had disturbed and passed over my head at such a pace and with such a noise that I was considerably startled; in a second or two it was so far away over the valley that I had no chance to verify the species.

54. The Kestrel—*Falco tinnunculus*, L.

Common about Fagoo and continually engaged in altercations with larger raptores.

55. The Indian Turtle Dove—*Streptopelia turtur ferrago*, (Eversm.)

During my visit to Kufri in August this dove had been very common along the road, but it was probably then on migration and had moved away later, as on this trip I found it to be comparatively scarce, only five or six individuals being seen in all.

56. The Common Peafowl—*Pavo cristatus*, Linn.

A single pea-hen was flushed in some Ilex jungle at about 7,000 feet when we were beating for pheasants.

57. The White-crested Kalij Pheasant—*Gennæus albocristatus*, (Vig.).

I devoted two days of my short time to looking for pheasants and found that this species was sufficiently common on a ridge near Fagoo. The summit of the ridge was about 7,500 feet in elevation and comprised a "protected forest" of dark and gloomy Deodar jungle with comparatively little undergrowth. Below the protected area patches of pines and Ilex alternated with open hillside and cultivation, the trees usually occupying those parts of the ground too steep for cultivation.

The main head-quarters of the pheasants was of course in the protected area but from there they straggled freely down to the woods in the open, and were apparently most numerous in the close neighbourhood of the villages. Owing to the distance from Fagoo I was not out in the early morning or late evening which was stated to be the best time to shoot the birds as they then collected in and about the fields, but I found that in the afternoon many pheasants certainly were to be found in the isolated patches of wood between the fields.

These pheasants were usually found in small parties of which the individuals rose singly and, when flushed, especially by a dog, frequently settled in a tree at no great distance where they sat motionless. On rising the curious guinea pig like squeak, familiar to all keepers of the ornamental silver pheasant, was freely uttered. A good many birds appeared to be killed by natives who shoot the bird at roost or use dogs to make it take to the trees.

On other days while collecting I came upon two or three pheasants in heavy undergrowth elsewhere and found then that they sat very close, rising as a rule within a yard or two of my feet. These were, however, I believe Koklas (*Pucrasia macrolophus*) but in no case did I get a clear view for identification.

58. The Chukar Partridge—*Caccabis chukar*, (Gray).

I discovered in the course of collecting where two or three coveys were living on the open bush clad hillside near Fagoo, but could not spare the time to make a determined effort to circumvent them.

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY

OF THE

BOMBAY NATURAL HISTORY SOCIETY.

By R. C. Wroughton, F.Z.S.

Part IV.

(*Continued from page* 379 *of Volume XXVI.*)

Subfamily II.—Marmotinæ.

Gen.—Marmota.

There is only one genus. The name Arctomys, used by Blanford, was proposed by Schreber in 1780, but Blumenbach had already given to the genus the name Marmota in 1779.

No. 259. *himalayanus*, Hodgs.
No. 260. *hodgsoni*, Blanf.
No. 261. *caudatus*, Jacq.

The material available in this group is very scanty, especially of the more eastern forms. Even with the help of Hodgson's types and drawings I cannot convince myself that there is any specific difference between his *himalayanus* and *hemachalanus* (i.e., *hodgsoni*, Blanf.), and propose to treat the latter name as a synonym of the former, at any rate until, if ever, there is material to prove to the contrary. Good series of marmots, from both slopes of the eastern Himalaya, are a great desideratum. Thomas has recently examined the more western forms, belonging to the *caudatus* group (J. B. N. H. S. xxiv, p. 341, 1916), when he added *stirlingi* to the existing species. The species described by him in 1909 (A. M. N. H. (8) iii, p. 259), namely, *littledalei*, has not been taken in our limits, but only on the Pamir. I have however included it, as well as *dichrous*, Anderson, from Kabul, in the following key:—

Key to the genus Marmota.

A.—General colour greyish … … 1. *himalayana*, Hodgs.
B.—General colour fulvous or brown.
  a. General colour fulvous.
    a^1. Size large, hind foot 100 mm.; back broadly washed with black. 2. *caudata*, Jacq.
    b^1. Size smaller, hindfoot 70-80 mm.; no black splash on back.
      a^2. No dark crown; area between cheek and shoulder grizzled; belly hairs broadly brown basally … … … 3. *stirlingi*, Thos.

b^2. Crown of head dark; no grizzled shoulder patch; little or no brown at base of belly hairs.. 4. *littledalei*, Thos.
b. General colour dark brown above and below ... ... 5. *dichrous*, And.

DISTRIBUTION :—

1. *M. himalayana*, Hodgson.	*Type locality*:—Nepal. (Hodgson). *Other localities* :—Ladak (Ward); Sikkim (Mandelli); Garwhal (Longstaff); Kashmir (Whitehead) (B.M.) *Type* :—B. M. No. 45.1.8. 239. (Co-types of *hemachalanus*, Hodgson, B. M. Nos. 45.1.8.237 and 238, Lectotype, B. M. No. 45.1.8.237).
2. *M. caudata*, Jacquemont.	*Type locality* :—Kashmir. (Jacquemont). *Other localities* :—Kagan Valley, Hazara District. (Whitehead) (B.M.). *Type* :—Unknown.
3. *M. stirlingi*, Thomas.	*Type locality* :—Chitral, 11,000′. (B. N. H. S.—Stirling). *Other localities* :—None. *Type* :—B. M. No. 15.7.1.10.
4. *M. littledalei*, Thomas.	*Type locality* :—Alai Mountains, Pamir. (Littledale). *Other localities* :—None. *Type* :—B. M. No. 92. 1. 1. 7.
5. *M. dichrous*, Anderson.	*Type locality* :—Hills North of Kabul. *Other localities* :—None. *Co-type and Lectotype* :—B. M. No. 76. 2. 12. 3.

Family II.—DIPODIDÆ.

A single species only of this Family is represented in the Indian region, for which, or rather for its representative in Central Asia, Nehring in 1897, provided the subgeneric name ALACTAGULUS. It may now be treated as a full genus.

Gen. ALACTAGULUS.

No. 262, *indica*, Gray.	This is the only form found within Indian limits.

DISTRIBUTION :—

A. indicus, Gray.	*Type locality* :—Kandahar. *Other localities* :—Kandahar ; N. W. Frontier. (B. M.). *Co-types* :—B. M. No. 44.9.15.4 & 5. *Lectotype* :—B.M. No. 44.9.15.4.

Family III.—GLIRIDÆ.

There is only one genus.

Gen.—PLATACANTHOMYS.

No. 263. ***lasiurus***, Bly. This is the only species.

DISTRIBUTION :—

P. lasiurus, Blyth.	*Type locality* :—South Malabar (Rev. H. Baker.) *Other localities* :—South Malabar ; Travancore (B. M.) ; South Coorg (M.S.I.). *Co-type* :—B.M. No. 60.5.13.1.

Family IV.—MURIDÆ.

The three Subfamilies may be distinguished as follows :—

Key to the Subfamilies of the MURIDÆ.

A.—Tail markedly longer than half the head and body together.
  a. Tail well covered with hair, usually with a tassel of longer hairs at the tip ; feet abnormally long in proportion to size ... ... I. GERBILLINÆ.
  b. Tail sparsely haired, showing the scales, no marked tassel ; feet of normal length ... ... II. MURINÆ.
B.—Tail less than half as long as the head and body together ... ... III. CRICETINÆ.

Subfamily I.—GERBILLINÆ.

The genus GERBILLUS was founded by Desmarest in 1804, and seven years later Illiger separated MERIONES for an animal from the Caspian region, while in 1881 and 1882 Lataste separated DIPODILLUS and TATERA for Egyptian and Indian forms. These four genera may be arranged in a key as follows :—

Key to the genera of the GERBILLINÆ.

A.—Size small, head and body 80 mm. or less.
  a. Sole of foot hairy ; one large metacarpal pad. ... ... I. GERBILLUS.

b. Sole of foot naked ; two metacarpal pads. II. Dipodillus.
B.—Size large, head and body 100-175mm.
  a. Sole of foot at least partly hairy ... III. Meriones.
  b. Sole of foot entirely naked. ... ... IV. Tatera.

Gen.—Gerbillus.

No. 268. *gleadowi*, Murr. The only species in the Indian region.

Distribution :—

G. gleadowi, Murray.	*Type locality* :—Rohri, Sind. (Gleadow.) *Other localities* :—Thar and Parkar (B. M.) ; Palanpur (M. S. I.). *Type* :—Unknown.

Gen. II.—Dipodillus.

No. 267. *nanus*, Blanf. Besides this species, *swinhoei*, Scully, was taken near Kandahar, and as pointed out by Blanford, (Mamm., p. 400), is likely to be taken at Quetta. These two species may be distinguished as follows :—

Key to the species of Dipodillus.

A.—Size smaller, head and body about 70 mm. ; tail longer, about 110 mm. ... 1. *nanus*, Blanf.
B.—Size larger, head and body about 85 ; tail shorter, about 75 mm. ... ... 2. *swinhoei*, Scully.

Distribution :—

1. *D. nanus*, Blanford.	*Type locality* :—Gwadar, Baluchistan. (Blanford). *Other localities* :—Palanpur; Kathiawar (M. S. I.). *Co-types* :—Ind. Mus. Calc. No. *a.* and B. M. No. 74. 11. 21. 39.
2. *D. swinhoei*, Scully.	*Type locality* :—Between Kandahar and the Khojak Pass. (Scully). *Other localities* :—None. *Type* :—B. M. No. 81. 8. 16. 9.

Gen. III.—Meriones.

No. 265. *hurrianæ*, Jerd.
No. 266. *erythrura*, Gray. These two species may be distinguished as follows :—

Key to the species of Meriones.

A.—Sole of feet only distally hairy ; ears small ... ... 1. *hurrianœ*, Jerd.
B.—Sole of feet almost entirely hairy ; ears large ... ... 2. *erythrourus*, Gr.

DISTRIBUTION :—

1. *M. hurrianæ*, Jerdon.	*Type locality* :—Hariana, Punjab (Jerdon). *Other localities*:—Dasht, Baluchistan; Kotah; Attok; Delhi (B. M.). *Co-types* :—B. M. No. 67. 2. 4. 1. and 71. 4. 11. 3. *Lectotype* :—B. M. No. 67. 2. 4. 1.
2. *M. erythrourus*, Gray.	*Type locality* :—Kandahar. *Other localities* :—Kandahar (B.M.) *Type* :—B. M. No. 44. 9. 15. 8.

Gen. IV.—TATERA.

No. 264. *indicus*, Hardw. Quite recently in this Journal (Vol. xxv, p. 40, 1917), I examined this genus and suggested the revival of the names *cuvieri*. Waterh., *hardwickei*, Gray, and *ceylonica*, Wr., and the establishment of two new species, *viz.*, *sherrini* and *dunni* for the northern forms. These six forms may be arranged in a key as follows :—

Key to the species of TATERA.

A.—Feet and tail short, only exceptionally exceeding 40mm. and 190mm. respectively.	
a. General colour hazel	1. *indica*, Hardw.
b. General colour greyish.	
a^{I}. General colour grey-drab. ...	2. *sherrini*, Wr.
b^{I}. General colour pinkish drab. ...	3. *dunni*, Wr.
B.—Feet and tail longer, at least 44mm. and 200mm. respectively.	
a. Anterior palatal foramina long (10mm.); general colour hazel ...	7. *hardwickei*, Gray.
b. Anterior palatal foramina short (6—7mm.)	
a'. General colour buffy	5. *cuvieri*, Waterh.
b'. General colour reddish	6. *ceylonica*, Wr.

DISTRIBUTION :—

1. *T. indica*, Hardwicke.	*Type locality* :—Kumaon (?). *Other localities* :—Nasirabad (Boys); Khandesh; Ahmednagar (B. M.); Kathiawar; Palanpur; Khandesh; Central Provinces; Gwalior; Bengal Kumaon (M. S. I.). *Type* :—B. M. No. 11.*g*.

2. *T. sherrini*, Wroughton. *Type locality* :—Jacobabad, Sind. (B. N. H. S.—Prater).
Other localities :—Upper Sind Frontier (M. S. I.).
Type :—B. M. No. 15. 11. 1. 88.

3. *T. dunni*, Wroughton. *Type locality* :—Umbala, Punjab (Maj. Dunn).
Other localities :—Umbala (B. M.).
Type :—B. M. No. 9. 4. 6. 10.

4. *T. hardwickei*, Gray. *Type locality* :—Dharwar (Elliot).
Other localities :—Dharwar ; Travancore (B. M.); Satara ; Dharwar ; Kanara ; Coorg (M. S. I.).
Co-types :—B. M. Nos. 11.*e.* and *h.*
Lectotype :—B. M. No. 11.*e.*

5. *T. cuvieri*, Waterhouse. *Type locality* :—Ramnad, Madura.
Other localities :—Trichinopoly ; Tinnevelly ; Madura (B. M.) ; Bellary ; Mysore (M. S. I.).
Type :—B. M. No. 55. 12. 24. 135.

6. *T. ceylonica*, Wroughton. *Type locality* :—Ceylon (Kelaart).
Other localities :—Maha Oya, Mankeni, Colombo, Kala Oya, and Southern Province, Ceylon (M. S. I.).
Type :—B. M. No. 52. 5. 9. 31.

Subfamily II.—Murinæ.

It is in this group, as was to be expected, that we get the widest divergence between Blanford's nomenclature, &c., and the currently accepted view. In Linnæus' classification the genus Mus included not only the Subfamily Murinæ, nor even only the whole Family Muridæ, but embraced forms which are now accepted as belonging to quite different Suborders, *e.g.*, the Marmots and the Guinea-Pigs. Of course Blanford's classification was a great advance on this but he recognised only seven genera of Murinæ, whereas now no less than twenty-three are accepted. Of these, besides the genera used by Blanford, only three, *viz.* :—Apodemus, Bandicota, and Rattus, were established before 1888, and have since been revived. All the remainder, except Gunomys, Hadromys and Hæromys have been established, directly or indirectly, as the result of the Survey.

The following is an alphabetical list of the Indian genera of Murinæ now recognised, with the reference and genotype in each instance :—

(1) Acomys, Geoffroy, Ann. Sci. Nat.
(2) x., p. 126, 1838... ... *A. cahirinus*, Geoffroy.

(2)	Apodemus, Kaup., E-G. N. S. i., p. 150, 1829	*A. agrarius*, Pallas.
(3)	Bandicota, Gray, A. M. N.H. (4) xii., p. 418, 1873	*B. gigantea*, Hardwicke.
(4)	Chiropodomys, Peters M. B. Ak. Berl., p. 448, 1868	*C. penicillatus*, Peters.
(5)	Cœlomys, Thomas, J. B. N. H. S. xxiii., p. 414, 1915	*C. mayori*, Thomas.
(6)	Cremnomys, Wroughton, J. B. N. H. S. xxi., p. 340, 1912	*C. cutchicus*, Wroughton.
(7)	Dacnomys, Thomas, J. B. N. H. S. xxiv., p. 404, 1916	*D. millardi*, Thomas.
(8)	Golunda, Gray, Ch. M. N. H. i., p. 586, 1837	*G. ellioti*, Gray.
(9)	Grypomys, Thomas, J. B. N. H. S. xx., p. 909, 1911	*G. gleadowi*, Murray.
(10)	Gunomys, Thomas, A. M. N. H. (7) xx, p. 203, 1907	*G. bengalensis*, Gr. & H.
(11)	Guyia, Thomas, J. B. N. H. S. xxv., p. 201, 1917	*G. kathleenæ*, Thomas.
(12)	Hadromys, Thomas J. B. N. H. S. xx., p. 999, 1911	*H. humei*, Thomas.
(13)	Hæromys, Thomas, A. M. N. H. (8) vii., p. 207, 1911	*H. margarettæ*, Thomas.
(14)	Hapalomys, Blyth, J. A. S. B. xxviii., p. 296, 1859	*H. longicaudatus*, Blyth.
(15)	Leggada, Gray, Ch. M. N. H. i., p. 586, 1837	*L. booduga*, Gray.
(16)	Leggadilla, Thomas, J. B. N. H. S. xx., p. 682, 1914	*L. platythrix*, Bennett.
(17)	Micromys, Dehne. Ein neues Säug. Faun. Dresd, p. 1, 1841.	*M. agilis*, Dehne.
(18)	Millardia, Thomas, J. B. N. H. S. xx., p. 998, 1911	*M. meltada*, Gray.
(19)	Mus, L., Syst. Nat. i., p. 59, 1758.	*M. musculus*, L.
(20)	Nesokia, Gray, A. M. N. H. (1) x., p. 264, 1842	*N. indica*, Gray & Hardw.
(21)	Pyromys, Thomas, J. B. N. H. S. xx., p. 996, 1911	*P. priestleyi*, Thomas.
(22)	Rattus, Fischer, Nat. Mus. Paris. ii., p. 128, 1803	*R. rattus*, L.
(23)	Vandeleuria, Gray, A. M. N. H. (1) x., p. 265, 1842	*V. oleracea*, Bennett.

Miss Ryley and I published some years ago (J. B. N. H. S. xxii., p. 19, 1913), a key to the genera of the Murinæ, but some genera have been established, and one or two names changed, since then, so with the corrections thus rendered necessary, I republish our key as follows :—

Key to the genera of the MURINÆ.

I.—Tubercles on anterior lower molar in two longitudinal series.
  A.—Coat composed at most of one half spines.
    a. Postero-internal cusp of upper molars absent.
      a^1. Incisors not longitudinally grooved.
        a^2. Front edge of zygomatic plate straight or convex.
          a^3. All digits except the pollex with claws.
            a^4. Anterior upper molar at most half the length of the entire tooth-row; terminal edges of incisors not notched; frontal ridges present.
              a^5. Plantar pads six.
                a^6. Transverse laminæ of upper molars straight.
                  a^7. Size large; head and body more than 250 mm.; *coat harsh; mammæ* 3—3=12 ... I. BANDICOTA
                  b^7. Size smaller; head and body at most 225 mm.
                    a^8. Palatal foramina long (8 mm.); *coat harsh multimammate* (16 *to* 18 *mammæ*) ... II. GUNOMYS.
                    b^8. Palatal foramina short (5 mm.); *mammæ* 2—2 = 8 ... ... III. NESOKIA.
                b^6. Transverse laminæ of upper molars considerably curved.

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a^7. Mesopterygoid fossa normal.

a^8. Mammæ more than six; *coat silky, sometimes mixed with spines.*

a^9. Tooth-row actually and proportionately longer, more than 10 mm. ... IV. Dacnomys.

b^9. Tooth-row shorter, less than 10 mm. V. Rattus.

b^8. Mammæ 1-2=6; coat silky ... VI. Cremnomys.

b^7. Mesopterygoid fossa roofed in anteriorly; *coat spiny*; mammæ 4—2=12 ... VII. Pyromys.

b^5. Plantar pads less than six.

a^6. Pectoral mammæ present.

a^7. Mammæ 1—2=6. VIII. Grypomys.

b^7. Mammæ 2—2=8. IX. Millardia.

b^6. No pectoral mammæ; mammary formula 0—2=4 ... ... X. Guyia.

b^4. Anterior upper molar more than half the tooth row.

a^5. Bevelled edges of incisors notched; palatal foramina extending backwards deeply between the molars.

a^6. Frontal ridges well marked ... ... XI. Leggadilla

b^6. No frontal ridges.

a^7. Muzzle shorter; essentially housemice XII. Mus.

b^7. Muzzle longer; essentially junglemice XIII. Leggada.

b^5. Bevelled edges of incisors not notched; palatal foramina shorter; no frontal ridges. XIV. Coelomys.

b^3. Other digits, besides the pollex, with a flat nail instead of a claw.

a^4. First and fifth digits of all feet with flat nails; *coat silky*; *mammæ* 2—2=8... XV. Vandeleuria.

b^4. Hallux and pollex alone with nail ... ... XVI. Hæromys.

b^2. Front edge of zygomatic plate concave; *coat harsh*; *mammæ* 2—2=8 ... ... XVII. Hadromys.

b^1. Incisors longitudinally grooved; *coat harsh*; *mammæ* 1—2=8; plantar pads six ... ... XVIII. Golunda.

b. Postero-internal cusp of upper molars present.

a^1. Mammæ 0—2=4 ... ... XIX. Chiropodomys.

b^1. Mammæ 2—2=8.

a^2. Tail not prehensile ... ... XX. Apodemus.

b^2. Tail prehensile... ... ... XXI. Micromys.

B.—Coat composed entirely of spines ... XXII. Acomys.

II.—Tubercles on anterior lower molar in three longitudinal series; *coat silky*; *mammæ* 2—2=8 ... ... XXIII. Hapalomys.

Gen. I.—Bandicota.

Blanford uses Nesocia (as he spelt it) for all this group, but Thomas restricted the name to the extreme northern and western forms, and at the same time revived the genus Bandicota and established Gunomys (A. M. N. H. (I), xx., p. 202, 1907).

In a paper in this Journal (J. B. N. H. S. xviii., p. 748, 1908) I discussed this group, and recognised five species (using *indica*, Bechstein for *bandicota*, Bechstein, as being the earlier of the two names), and Thomas has recently added another, *viz.*:—*savilei* (J. B. N. H. S. xxiv., p. 641, 1916). These six species may be arranged in a key as follows:—

No. 296. *bandicota*, Bechs.
No. 297. *nemorivaga*, Hodgs.

Key to the species of Bandicota.

A.—Size very large, hind-foot more than 60 mm. ... ... 1. *gigantea*, Hardw

B.—Size smaller, hind-foot 58 mm. or less.
  a. Hind-foot about 58 mm.; colour of underfur brown ... ... 2. *malabarica*, Shaw.
  b. Hind-foot 51 mm. or less.
    a^1. Hind-foot 48-51 mm.
      a^2. Colour almost black.
        a^3. Skull stouter, coarser ... 3. *elliotana*, And.
        b^3. Skull more finely built ... 4. *indica*, Bechst.
      b^2. Colour brown ... ... 5. *nemorivaga*, Hodgs.
    b^1. Hind-foot only 43 mm. ... ... 6. *savilei*, Thomas.

DISTRIBUTION :—

1. *B. gigantea*, Hardwicke. *Type locality* :—Hardwar, United Provinces.
Other localities :—Rajputana; Delhi (B. M.); Kathiawar; Junagadh (M. S. I.)
Type :—B. M. No. 60. 5. 4. 84.

2. *B. malabarica*, Shaw. *Type locality* :—Malabar Coast.
Other localities :—Travancore; Ceylon (B. M.); Central Provinces; Satara; Dharwar; Kanara; Mysore; Coorg; Ceylon (M. S. I.).
Type :—Unknown.

3. *B. elliotana*, Anderson. *Type locality*:—Calcutta (Anderson).
Other localities :—Palamow (B. M.); Bengal; Bhutan Duars (M. S. I.).
Co-types : Ind. Mus. Calc. Nos. *a.* *b.* and *c.*

4. *B indica*, Bechstein. *Type locality* :—Pondichery.
Other localities:--Nilgiri Hills(B.M.).
Type :—Unknown.

5. *B. nemorivaga*, Hodgson. *Type locality* :—Nepal (Hodgson).
Other localities :—Nepal; Khasi Hills; Tounghoo; Yunnan; Formosa (B. M.).
Co-types :—B. M. Nos. 43.1.12.67 and 68. (Type of *macropus*, Gray, and of *hydrophilus*, Hodgson, B. M. No. 45.1.8.286).
Lectotype :—B. M. No. 43.1.12.67.

6. *B. savilei*, Thomas. *Type locality* :—Mount Popa, Burma (B. N. H. S.—Shortridge).
Other localities :—Mount Popa (M. S. I.).
Type :—B. M. No. 14. 7. 19. 211.

Gen. II.—GUNOMYS.

Thomas established this genus to represent the southern or long-tailed mole-rats (A. M. N. H. (7), xx., p. 203, 1907.)

No. 295. *bengalensis*, G. & H.

In my paper quoted above, I accepted eight species which were recorded to occur within our area. Additional material however shows that the separation of *tarayensis*, Horsf. from *bengalensis*, cannot be maintained, consequently as the later name the former must rank as a synonym of the latter. The remaining seven may be arranged in a key as follows:—

Key to the species of GUNOMYS.

A.—Teeth smaller, upper molar series less than 7·5 mm.
- *a.* Size larger, head and body more than 200 mm., hind foot about 35 mm.; skull length 43 mm. ... ... 1. *bengalensis*, G. & H.
- *b.* Size smaller, head and body less than 200 mm., hind foot 32 mm.; skull length 41 mm. ... ... 2. *gracilis*, Nehr.

B.—Length of upper molar series more than 7·5 mm.
- *a.* Coat fine, silky, long (25 mm.); hind-foot 37 mm. ... ... 3. *wardi*, Wroughton.
- *b.* Coat coarser, soft or harsh, shorter (13-16 mm.).
  - a^1. Size large, head and body more than 200 mm., fur coarse and harsh.
    - $a.^2$ Length of upper molar series 7·6 mm.; hind foot about 40 mm.; Colour mixed buff and black ... ... 4. *varius*, Thos.
    - $b.^2$ Length of upper molar series 8 mm.; hind foot about 40 mm.; colour brown ... ... 5. *lordi*, Wroughton.
  - b^1. Size smaller, head and body less than 200 mm.; hind foot about 35 mm.
    - $a.^2$ Fur coarse and harsh; upper molar series 8·3 mm. ... 6. *sindicus*, Wroughton.
    - b^2. Fur fine and soft; upper molar series 8 mm. ... ... 7. *kok*, Gray.

DISTRIBUTION :—

1. *G. bengalensis*, Gray and Hardwicke.	*Type locality* :—Bengal. *Other localities* :—Nepal ; Calcutta (B. M.) ; Kumaon ; Darjiling ; Bihar ; Orissa (M. S. I.). *Type* :—Not traced. (Type of *daccaensis*, Tytler, B. M. No. 79. 11. 21.427. Type of *tarayensis*, Horsfield, B. M. No. 79. 11. 21. 426. Type of *morungensis*, Horsfield, B. M. No. 79.11.21.408. Type of *plurimammis*. Horsfield, B. M. No. 79.11.21.409. Type of *barclayana*, Anderson, Ind. Mus. Calc. No. *g*—*h*. Type of *blythianus*, Anderson, not traced).
2. *G. gracilis*, Nehring.	*Type locality* :—Ceylon. *Other localities* :—Kandy (B. M.) ; Kandy ; Tammanewa (M. S. I.). *Type* :—In the Agricultural Museum, Berlin. (Type of "*Mus dubius*," Kelaart, B. M. No. 52. 5. 9. 22.).
3. *G. wardi*, Wroughton.	*Type locality* :—Pandritton, Kashmir. (Ward—Crump). *Other localities* :—Pandritton (Ward) (B. M.). *Type* :—B. M. No. 8. 7. 6. 34.
4. *G. varius*, Thomas.	*Type locality* :—Penang, Malay Peninsula. *Other localities* :—Pegu ; Mergui (M. S. I.). *Type* :—B. M. No. 98. 8. 3. 3.
5. *G. lordi*, Wroughton.	*Type locality* :—Kolaba District (B. N. H. S.—Lord). *Other localities* :—Kolaba District (Lord) (B. M.). *Type* :—B. M. No. 8.9.13.1.
6. *G. sindicus*, Wroughton.	*Type locality* :—Pithoro (Central Sind Desert (Government of Bombay). *Other localities* :—Pithoro (Bombay Government) (B. M.). *Type* :—B. M. No. 8.9.13.7.
7. *G. kok*, Gray.	*Type locality* :—Dharwar. (Elliot). *Other localities*:—Rajputana (Boys) ; Surat ; Ahmednagar (Fairbank) ;

Nilgiris (B. M.); Junagadh; Palanpur; Khandesh; Nimar; Central Provinces; Satara; Dharwar; Bellary; Mysore; Coorg (M. S. I.).

Co-types:—B. M. No. 30 *b.c.*, &c. (Co-types of *providens*, Elliot, are the same as those of *kok*).

Lectotype:—B. M. No. 30 *c.*

Gen. III.—NESOKIA.

This name, used by Blanford for the whole group, was restricted by Thomas (l.c. supra) to include only the short tailed mole-rat of northern India, which also has representatives as far north and west as the Caspian Sea and Egypt.

No. 294. *hardwickei*, Gray.

In my paper, twice quoted above, I pointed out that the name *hardwickei* was antedated by *indica*, G. and H. Out of ten species of this genus, dealt with in that place, only four belong to our fauna, and these may be arranged in a key as follows:—

Key to the species of NESOKIA.

A.—Coat soft and silky.
  a. Colour duller, rufous brown.
    a.^{1} Fore-claws long and sharp ... 1. *indica*, G. & H.
    b.^{1} Fore-claws short and blunt ... 2. *griffithi*, Horsf.
  b. Colour ochraceous ... ... 3. *huttoni*, Blyth.
B.—Coat harsh ... ... 4. *beaba*, Wr.

DISTRIBUTION:—

1. *N. indica*, Gray and Hardwicke. *Type locality*:—"India."
Other locality:—Rajputana (B. M.).
Type:—B. M. No. 99*a*. (Type of *hardwickei* the same).

2. *N. griffithi*, Horsfield. *Type locality*:—"Pushut," N. W. Frontier. (Griffiths).
Other localities:—Kuram Valley; Kohat; Hassan Abdul; Rawal Pindi (B.M.); Kumaon (M. S. I.).
Type:—B. M. No. 79.11.21.401.

3. *N. huttoni*, Blyth. *Type locality*:—Kandahar (Hutton).
Other localities:—Baluchistan (Blanford); Quetta (Quetta Museum) (B. M.); Sukkur, Sind (M.S.I.).
Type:—B. M. No. 79.11.21.499.

4. *N. beaba*, Wroughton.

Type locality :—Pithoro, Central Sind Desert. (Govt. of Bombay).

Other localities :—Pithoro (Bombay Government).

Type :—B. M. No. 8. 9. 13. 9.

Gen. IV.—Dacnomys.

Blanford had no knowledge of this animal; the genus was established by Thomas to receive it. (J. B. N. H. S., xxiv., p. 404, 1916). There is only the one species.

Distribution :—

D. millardi, Thomas.

Type locality :—Gopaldhara, Darjiling. (B. N. H. S.—R. S. Lister).

Other localities :—Pashok, Darjiling (M. S. I.).

Type :—B. M. No. 16. 3. 25. 98.

Gen. V.—Rattus.

The separation of the rats subgenerically from the mice (Mus), under the name Epimys, was proposed by Trouessart in 1881 (Bull. Soc. Sci. d'Angers). It was accepted as a full genus by Miller in 1910 (Proc. Biol. Soc. Wash. xxiii, p. 58.) Hollister, however, recently showed that the oldest name for the genus is Rattus (Proc. Biol. Soc. Wash., p. 126, 1916), and must be used in place of Epimys.

No. 272. *rattus*, L.
No. 273. *concolor*, Bl.
No. 274. *decumanus*, Pall.
No. 275. *fulvescens*, Gray.
No. 276. *bowersi*, And.
No. 277. *berdmorei*, Bl.
No. 278. *blanfordi*, Thos.
No. 279. *jerdoni*, Bl.
No. 280. *niveiventer*, Hodgs.

These are the nine species of the genus recognised by Blanford. I cannot find a single authentic record of the taking of *decumanus* in India, outside the docks of seaside towns, and propose to omit it from this list; *jerdoni* I have shown (J. B. N. H. S. xxiv, p. 489, 1916), to be a synonym of *fulvescens*, and it also therefore drops out of this list. On the other hand, however, a number of new names must be added. The species *surifer*, Miller, and *vociferans*, Miller, have been found to intrude into our area. Besides *mackenziei*, and *m. feœ*, allied to *bowersi*, Anderson, and *manipulus*, and *berdmorei mullulus*, allied to *berdmorei*, Blyth, Thomas has described the new species *listeri* (J.B. N. H. S. xxiv, pp. 407—414, 1916), and *mentosus* (J. B. N. H. S. xxiv, p. 643, 1916). I have myself described the species *lepcha* and *eha*, allied to *niviventer* and *fulvescens* respectively (1. c. p. 427). Finally Mr. Hinton in his study of the *rattus* group has added eight names in that group. To these must be added Bonhote's species *vicerex*, which, if it does not belong to it, comes very close to it. Thomas also has described (A. M. N. H. (7), xx., p. 206, 1907) a species, *rogersi*, from the Andaman Islands. All these forms may be arranged in a key as follows:—

Key to the species of RATTUS.

- *A.*—Tail unicolor throughout, above and below.
  - *a.* Hind-foot 45 mm. or more.
    - a^1. Size very large, hind-foot 56mm. 1. *validus*, Mill.
    - b^1. Size smaller, hind-foot 45 mm. ... 2. *andamanensis*, Bl.
  - *b.* Hind-foot less than 40 mm.
    - a^1. Mammæ, 10 or 12 ... ... 3. *rattus* group. (for key see below).
    - b^1. Mammæ 8 ... ... 4. *concolor*, Bl.
- *B.*—Tail not unicolor.
  - *a.* Tail bicolor, distal portion white.
    - a^1. Mammæ 3 - 2=10.
      - a^2. Size smaller, hind-foot 37 mm... 5. *manipulus*, Thos.
      - b^2. Size larger, hind-foot 48 mm. or more.
        - a^3. Hind-foot about 48 mm.; at least one-third of tail white 6. *mackenziei*, Thos.
        - b^3. Hind-foot about 51 mm.; only extreme tip of tail white... 7. *m. feæ*, Thos.
    - b^1. Mammæ less than 10.
      - a^2. Two rairs of pectoral mammæ.
        - a^3. Smaller, hind-foot about 37 mm. ... . 8. *bowersi*, And.
        - b^3. Larger, hind-foot about 47mm. 9. *listeri*, Thos.
      - b^2. Only one pair of pectoral mammæ.
        - a^3. Mammæ 1—2=6 ... ... 10. *blanfordi*, Thos.
        - b^3. Mammæ 1—3=8 ... ... 11. *rogersi*, Thos.
  - *b.* Tail throughout dark above, pale below.
    - a^1. Mammæ 3—2=10.
      - a^2. Upper incisors thrown forward, forming an obtuse angle with the palate.
        - a^3. Upper molar series 6·5 mm. in length ... ... 12. *berdmorei*, Bl.
        - b^3. Upper molar series 6 mm. in length ... ... 13. *b. mullulus*, Thos.
      - b^2. Upper incisors not thrown forward, forming a right angle with the palate ... ... 14. *vicerex*, Bonh.

b^1. Mammæ 2—2=8.
  a^2. Size large, hind-foot 45 mm. or more ... ... 15. *vociferans*, Mill.
  b^2. Size smaller, hind-foot less than 40 mm.
    a^3. Coat harsh and spiny.
      a^4. Colour dark brown ... 16. *mentosus*, Thos.
      b^4. Colour ochraceous ... 17. *surifer*, Mill.
    b^3. Coat soft and silky.
      a^4. Colour schraceous.
        a^5. Larger, head and body 130—140 mm. hind-foot about 30 mm. ... 18. *fulvescens*, Gray.
        b^5. Smaller, head and body 110—115 mm. hind-foot about 25 mm. ... 19. *eha*, Wroughton.
      b^4. Colour dark grey-brown.
        a^5. Belly pure white ... 20. *niviventer*, Hodgs.
        b^5. A dark gorget and median streak ... 21. *lepcha*, Wroughton.

DISTRIBUTION :—

1. *R. validus*, Miller.	*Type locality* :—Trong, 1,000′, Lower Siam. (Abbott). *Other localities* :—Malay Peninsula (B. M.) ; Tenasserim (M. S. I.). *Type* :—U. S. Nat. Mus. No. 86741.
2. *R. andamanensis*, Blyth.	*Type locality* :—Andaman Islands. (Hodgs.). *Other localities* :—Andamans (B.M.). *Co-types* :—B. M. Nos. 81.11.10.3 and 4, and Ind. Mus. Calc. Nos. *a.* and *b.*
3. *R. rattus*, group.	The members of this group, as recently accepted by Hinton (J. B. N. H. S. xxvi., pp. 59, 384), may be arranged in a key as follows :—

Key to the members of the R. rattus group.

I.—Tail shorter, averaging less than 120 % of head and body.
  A.—Tail relatively short, averaging about 108 % or less, of head and body.
    a. Tail scarcely longer than head and body ; fur short and thin ; underside not silvery, frequently with a rusty tinge ... ... (*a*) *n. obsoletus*, Hint.

b. Tail slightly longer, averaging about 108 % of head and body; fur long and thick.
a^1. Colour seal brown; underside silvery or hoary ... ... (*b*) *n. nitidus*, Hodgs.
b^1. Colour umber; underside white (*c*) *r. tikos*, Hint.
B.—Tail relatively long, averaging 117 % of head and body.
a. General colour dull greyish brown. (*d*) *r. tatkonensis*, Hint.
b. General colour brighter.
a^1. General colour with an ochreous tinge ... ... (*e*) *r. khyensis*, Hint.
b^1. General colour with a rufous tinge... ... ... (*f*) *kelaarti*, Wr.
II.—Tail longer, averaging more than 120 % of head and body.
A.—Ventral fur white to bases; lateral line of colour demarcation usually well defined (essentially wild rats).
a. Size large; mammæ normally 3—3=12.
a^1. Tails relatively longer, averaging 130 % of head and body.
a^2. Colour black, grizzled with tawny ... ... (*g*) *macmillani*, Hint.
b^2. Colour dark olive brown ... (*h*) *r. sikkimensis*, Hint.
b^1. Tails relatively shorter, about 125 % of head and body; colour cold grey or yellow, lined with black ... ... (*i*) *r. gangutrianus*, Hint.
b. Size variable; mammæ normally 2—3=10.
a^1. Fur full; dorsal colour warm and bright; tail length variable.
a^2. Dorsal colour olive brown.
a^3. Size larger; average length of head and body 145mm; tail shorter, about 123% of head and body ... (*j*) *r. tistæ*, Hint.
b^3. Size smaller; average length of head and body 137mm.; tail longer, 131% of head and body. ... ... (*k*) *r. bhotia*, Hint.

b^2. Dorsal colour not olive.

a^3. Backs bright clay or golden brown; tail very long, more than 150 % of head and body ... ... (*l*) *r. satarœ*, Hint.

b^3. Backs inclining to rufous, whitish bristles usually present;

a^4. Tail short, about 122 per cent. of head and body. (*k*) *r. wroughtoni*, Hint.

b^4. Tail longer, 132 per cent. of head and body ... (*l*) *r. kandianus*, Kel.

b^1. Fur rather short, thin, and harsh, but usually not spiny; dorsal colour cold and dull; tail long, about 135 per cent. of head and body.

a^2. Dorsal colour warmer, near cinnamon brown or tawny. (*m*) *r. arboreus*, B. Ham.

b^2. Dorsal colour colder and greyish.

a^3. Dorsal colour drab; long black hairs tending to form a middorsal stripe. . (*n*) *r. narbadœ*, Hint.

b^3. Dorsal colour drab grey; middorsal line decidedly darkened by black hairs; white of belly duller ... (*o*) *r. girensis*, Hint.

B.—Ventral fur slaty-based; no sharp line of colour demarcation along the flanks; (essentially commensal with man).

a. Dorsal colour rufous; hair of belly rough, with rusty tinge.

a^1. Tail shorter, 125 per cent. of head and body ... ... (*p*) *r. rufescens*, Gray.

b^1. Tail longer, 135 per cent. of head and body ... ... (*q*) *r. nemoralis*, Kel.

b. Dorsal colour rarely rufous; belly without rusty tinge.

a^1. Backs grey or brown; belly light grey or dusky, rough or smooth (*r*) *r. alexandrinus*, Geoff.

b^1. Back black; belly bluish grey, sleek-haired .... (*s*) *r. rattus*, L.

3(*a*).	*R. nitidus obsoletus*, Hinton.	*Type locality* :—Chin Hills. (Mackenzie). *Other localities* :—Chin Hills. (M. S. I.). *Type* :—B. M. No. 16. 3. 26. 52.
3(*b*).	*R. nitidus nitidus*, Hodgson.	*Type locality* :—Nepal. (Hodgson). *Other localities* :—Nepal ; Assam (B. M.) ; Kumaon ; Darjiling ; Sikkim ; Kalimpong (M. S. I.). *Type* :—B. M. No. 79.12.21.415. (Type of *pyctoris*, Hodgs., B. M. No. 45.1.8.381 ; Type of *equicaudalis*, Hodgs. B. M. No. 79.11.21.410).
3(*c*).	*R. rattus tikos*, Hinton.	*Type locality* :—Tenasserim (B. N. H. S.—Shortridge). *Other localities* :—Tenasserim (M. S. I.). *Type* :—B. M. No. 14. 12. 8. 168.
3(*d*).	*R. rattus tatkonensis*, Hinton.	*Type locality* :—Tatkon, Chindwin River (B. N. H. S.—Macmillan). *Other localities* :—Chindwin ; Upper Burma (M. S. I.). *Type* :—B. M. No. 15. 5. 5. 224.
3(*e*).	*R. rattus khyensis*, Hinton.	*Type locality* :—25 miles West of Kindat, 600′ ; Chindwin River (B. N. H. S.—Macmillan). *Other localities* :—Chindwin ; N. Shan States ; Mt. Popa ; Pegu (M. S. I.). *Type* :—B. M. No. 16. 3. 26. 57.
3(*f*).	*R. kelaarti*, Wroughton.	*Type locality* :—Pattipola, Ceylon (B. N. H. S.—Mayor). *Other localities* :—Central Ceylon, 5,000′—6,000′ (M. S. I.) *Type* :—B. M. No. 15. 7. 1. 7.
3(*g*).	*R. macmillani*, Hinton.	*Type locality* :—Hkamti, Chindwin River (B. N. H. S.—Macmillan). *Other localities* :—Hkamti (M. S. I.) *Type* :—B. M. No. 15.5.5. 226.
3(*h*).	*R. rattus sikkimensis*, Hinton.	*Type locality* :—Pashok, Darjiling (B. N. H. S.—Baptista). *Other localities* :—Ringin, Singhik, Rongli, Gopaldhara, Sikkim ; Bhutan Duars (M. S. I.). *Type* :—B. M. N. 17. 7. 2. 46.

3(*i*). *R. rattus gangutrianus*, Hinton.	*Type locality* :—Ranibagh, 2,500′, Kumaon. (B. N. H. S.—Crump). *Other localities* :—Kumaon, 1,100′—7,650′ (M. S. I.). *Type* :—B. M. No. 14. 7. 10. 127.
3(*j*). *R. r. tistæ*, Hinton.	*Type locality* :—Pashok, Darjiling (B. N. H. S.—Baptista). *Other localities* :—Narbong, Rongli, Gopaldhara, Batasia, Gangtok, Sedonchen, Sikkim (M. S. I.). *Type* :—B. M. No. 17. 7. 2. 13.
3(*k*). *R. r. bhotia*, Hinton.	*Type locality* :—Hasimara, Bhutan Duars (B. N. H. S.—Baptista). *Other localities* :—Hasimara (M. S. I.). *Type* :—B. M. No. 17. 7. 2. 20.
3(*l*). *R. r. sataræ*, Hinton.	*Type locality* :—Ghatmatha, Satara (B. N. H. S.—Prater). *Other localities* :—Satara (M. S. I.). *Type* :—B. M. No. 15. 7. 3. 56.
3(*m*). *R. r. wroughtoni*, Hinton.	*Type locality* :—Coonoor, Nilgiris (Wroughton). *Other localities* :—Dharwar ; Coonoor ; Travancore (B. M.) ; Dharwar ; Kanara ; Mysore ; Coorg (M. S. I.). *Type* :—B. M. No. 98. 3. 5. 26.
3(*n*). *R. r. kandianus*, Kelaart.	*Type locality* :—Newera Eliya, Ceylon. (Kelaart). *Other localities* :—Newera Eliya (B. M.) ; Kandy, Newera Eliya, &c.; Central Ceylon (M. S. I.). *Co-types* :—B. M. Nos. 52.5.9.24 25, and 26. (Type of *tetragonurandus* Kelaart, B. M. No. 52. 5. 9. 23). *Lectotype* :—B. M. No. 52. 5. 9. 26.
3(*o*). *R. r. arboreus*, Buch. Ham.	*Type locality* :—" Bengal." (B. Hamilton). *Other localities* :—Behar ; Bengal ; Orissa (M. S. I). *Type* :—Unknown.
3(*p*). *R. r. narbadæ*, Hinton.	*Type locality* :—Sakot, Central Provinces (B. N. H. S.—Crump). *Other localities* :—Central Provinces (M. S. I.) *Type* :—B. M. No. 12.11.29.132.

3(*q*). *R. r. girensis*, Hinton.	*Type locality* :—Sasan, Junagadh (B. N. H. S.—Crump). *Other localities* :—Southern Kathiawar (M. S. I). *Type* :—B. M. No. 13. 8. 8. 125.
3(*r*). *R.r.rufescens*, Gray.	*Type locality* :—Dharwar (Elliot). *Other localities* :—Rajputana; Guzerath; Dekhan; Konkan; S. Mahratha Country; Nilgiris; Kumaon; Rohilkund (B. M.) Cutch; Palanpur; Kathiawar; Gwalior; Khandesh; Central Provinces; Western Ghats; South Mahratha Country; Kanara; Mysore (M. S. I.). *Type* :—B. M. No. 44. 9. 15. 2.
3(*s*). *R. r. nemoralis*, Blyth.	*Type locality* :—Ceylon. (Kelaart). *Other localities* :—Ceylon (Kelaart). (B. M.); Southern Province; Ceylon (M. S. I.). *Co-types* :—Ind. Mus. Calc. No. q^6. and r^6.
3(*t*). *R. r. alexandrinus*, Geoffroy.	*Type locality* :—Alexandria, Egypt. *Other localities* :—Sind (M. S. I.). *Type* :—Unknown.
3(*u*). *R. r. rattus*, Linnæus.	*Type locality* :—Upsala, Sweden. *Other localities* :—Kanara; Rangoon; &c., (? imported) (M. S. I.). *Type* :—Unknown.
4. *R. concolor*, Blyth.	*Type locality* :—Shwegyin, Burma. (Berdmore). *Other localities* :—Siam; Malay Peninsula (B. M.) Chindwin; Mt. Popa; Tenasserim (M. S. I.). *Co-types* :—Ind. Mus. Calc. Nos. *e.*, *f.* and *g.*
5. *R. manipulus*, Thomas.	*Type locality* :—Kabaw Valley, Chin Hills. (Mackenzie). *Other localities* :—Manipur (B. M.); Chin Hills (M. S. I.). *Type* :—B. M. No. 16. 3. 26. 78.
6. *R. mackenziei*, Thomas.	*Type locality* :—Chin Hills. (Mackenzie). *Other localities* :—Khasi Hills (B. M.); Chin Hills (M. S. I.). *Type* :—B. M. No. 16. 3. 46. 65.

7. *R. mackenziei feæ*, Thomas.	*Type locality* :—Muleyit Range, Tenasserim. (Fea). *Other localities* :—Mt. Muleyit (B. M.). *Type* :—B. M. No. 88. 12. 1. 47.
8. *R. bowersi*, Anderson.	*Type locality* :—Kakhyen Hills, Burma (Anderson). *Other localities* :—Manipur (B. M.); Chin Hills; Mt. Popa (M. S. I.). *Type* :—Ind. Mus. Calc. No. *a*.
9. *R. listeri*, Thomas.	*Type locality* :—Pashok, Darjiling (R. S. Lister). *Other localities* :—Pashok, (M. S. I.). *Type* :—B. M. No. 16. 3. 25. 97.
10. *R. blanfordi*, Thomas.	*Type locality* :—Kadapa, Madras (Blanford). *Other localities* :—Matheran, Bombay; Shevaroy Hills; Central Provinces (B. M.); Berars; Central Provinces; Western Ghats; Kanara; Mysore; Coorg; Bengal (M. S. I.). *Type* :—B. M. No. 80.11.11.54.
11. *R. rogersi*, Thomas.	*Type locality* :—Ike Bay, South Andaman Island (Rogers). *Other localities* :—None. *Type* :—B. M. No. 6. 4. 13. 2.
12. *R. berdmorei*, Blyth.	*Type locality* :—Mergui, Burma (Berdmore). *Other localities* :—None. *Type* :—Ind. Mus. Calc. No. *a*.
13. *R. berdmorei mullulus*, Thomas.	*Type locality* :—Mt. Muleyit,(Fea). Burma. *Other localities* :—None. *Type* :—B. M. No. 16. 2. 16. 1.
14. *R. vicerex*, Bonhote.	*Type locality* :—Simla (Hume). *Other localities* :—Simla; Ladak; Murree, Punjab (B. M.) Kumaon; Sikkim (M. S. I.). *Type* :—B. M. No. 85. 8. 1. 313.
15. *R. vociferans*, Miller.	*Type locality* :—Trong, 1,000′, Lower Siam (Abbott). *Other localities* :—Malay Peninsula (B. M.); Tenasserim (M. S. I.). *Type* :—U. S. Nat. Mus. No. 86736.

16. *R. mentosus*, Thomas. *Type locality* :—Hkamti, Upper Chindwin (B. N. H. S.—Shortridge).
Other localities :—Upper Chindwin (M. S. I.).
Type :—B. M. No. 15. 5. 5. 232.

17. *R. surifer*, Miller. *Type locality* :—Trong, 3,000′, Lower Siam (Abbott).
Other localities :—Malay Peninsula (B. M.); Tenasserim (M. S. I.).
Type :—U. S. Nat. Mus. No. 86746.

18. *R. fulvescens*, Gray. *Type locality* :—Nepal (Hodgson).
Other localities :—Sikkim ; Khasi Hills (B. M.). Kumaon ; Sikkim ; Darjiling ; Kalimpong ; Chin Hills ; Shan States ; Tenasserim (M. S. I.).
Co-types :—B. M. Nos. 45.1.8.376 and 377.
Lectotype :—B. M. No. 45.1.8.376.

19. *R. eha*, Wroughton. *Type locality* :—Lachen, 8,000′, Sikkim (B. N. H. S.—Crump.).
Other localities :—Sikkim (B. M.) ; Sikkim (M. S. I.).
Type :—B. M. No. 15.9.1.189.

20. *R. niviventer*, Hodgson. *Type locality* :—Khatmandu, Nepal (Hodgson).
Other localities :—Simla, Nepal (B. M.) ; Kumaon ; Sikkim (M. S. I.).
Type :—B. M. No. 43. 1. 12. 73.

21. *R. lepcha*, Wroughton. *Type locality* :—Chuntang, 5,350′, Sikkim (B. N. H. S.—Crump.).
Other localities :—Sikkim (M. S. I).
Type :—B. M. No. 15. 9. 1. 185.

Gen. VI.—Cremnomys.

I established this genus for the rock-rat of Cutch (J. B. N. H.S., xxi, p. 340, 1912), one of the earliest discoveries of the Survey. There is nothing, of course, to correspond with it in the "Mammalia."

The genotype, *cutchicus*, was described at the same time as the genus, but later, when representatives had been found in other parts of India, Thomas studied them and distinguished five other forms. These six members of the genus may be arranged in a key as follows :—

Key to the forms of Cremnomys.

A.—Size smaller, hind-foot about 24 mm. ; skull about 33 mm. ; upper molar series 5.2-5·4 mm. ... ... 1. *cutchicus*, Wr.

B.—Size larger, hind-foot about 26·29 mm.; skull about 35 mm.

a. Underside almost pure white; upper molar series 5—5·4 mm. ... ... 2. *australis*, Thos.

b. Underside more or less grey.

a^{1}. Hind-feet long, 29 mm.; upper molar series 5·3 mm. ... ... 3. *aust. siva*, Thos.

b^{1}. Hind-feet shorter; upper molar series 5·6 mm.

a^{2}. No nuchal buffy patch.

a^{3}. Colour paler, "Prout's brown" 4. *medius*, Thos.

b^{3}. Colour darker, "seal brown". 5. *med. cœnosus*, Thos.

b^{2}. A buffy nuchal patch... ... 6. *med. rajput*, Thos.

DISTRIBUTION :—

1. *C. cutchicus*, Wroughton.	*Type locality* :—Cutch. (B. N. H. S.—Crump). *Other localities* :—Cutch (M. S. I.). *Type* :—B. M. No. 11. 10. 18. 1.
2. *C. australis*, Thomas.	*Type locality* :—Vijayanagar, Bellary (B. N. H. S.—Shortridge). *Other localities* :—Bellary; East Mysore (M. S. I.). *Type* :—B. M. No. 13. 4. 10. 57.
3. *C. australis siva*, Thomas.	*Type locality* ;—Sivasamundram, S. Mysore (B. N. H. S.—Shortridge). *Other localities* :—South Mysore; French Rocks, Seringapatam (M.S.I.) *Type* :—B. M. No. 13. 4. 11. 78
4. *C. medius*, Thomas.	*Type locality* :—Kudia, Junagadh (B. N. H. S.—Crump). *Other localities* :—Junagadh; Palanpur; Kathiawar (M. S. I.). *Type* :—B. M. No. 13. 8. 8. 128.
5. *C. medius cœnosus*, Thomas.	*Type locality* :—Singar Gaya, Bihar. (B. N. H. S.—Crump). *Other localities* :—Gujhundi; Hazaribagh (M. S. I). *Type* :—B. M. No. 15.4.3.137.
6. *C. medius rajput*, Thomas.	*Type locality* :—Mt. Abu, Rajputana. (B. N. H. S.—Crump). *Other localities* :—Mt. Abu, Rajputana (M. S. I). *Type* :—B. M. No. 13.9.18.40.

Gen. VII.—Pyromys.

The genus was established by Thomas (J. B. N. H. S., xx, p. 996, 1911), for a mouse taken by Mr. Priestley, Indian Police, in Sind. The genotype and only species was described at the same time. By the older mammalogists this animal was probably confused with *Leggadilla platythrix*.

Distribution :—

P. priestleyi, Thomas. *Type locality* :—Virawa, Thar and Parkar, Sind.—(Priestley).
Other localities :—None.
Type :—B. M. No. 11. 3. 13. 9.

Gen. VIII.—Grypomys.

The genus was founded by Thomas (J. B. N. H. S., xx, p. 999, 1911) for a mouse described by Murray from Sind.

No. 291. *gleadowi*, Murr. This is the genotype and only species.

Distribution :—

G. gleadowi, Murray. *Type locality* :—Karachi, Sind (Gleadow).
Other localities :—Thar and Parkar (B. M.) ; Kathiawar ; Palanpur (M. S. I.).
Co-Types :—B. M. Nos. 86.1.30.1 1—3.
Lectotype :—B. M. No. 86.1.30.1.

Gen. IX.—Millardia.

A genus made by Thomas (J. B. N. H. S., xx, p. 998, 1911) for the "metad" of the Southern Mahratha Country.

No. 290. *meltada*, Gray. Thomas, who has recently re-examined this group, recognises three subspecies besides the true *mel'ada*. The four may be distinguished as follows :—

Key to the subspecies of M. meltada, Gray.

A.—General colour darker, about "bistre.".
  a. Tooth-row longer, about 6 mm. ... 1. *m. meltada*, Gray.
  b. Tooth-row shorter, about 5.6 mm. ... 2. *m. listoni*, Wr.
B.—General colour paler, about "drab ".
  a. General colour grey ("drab grey"). 3. *m. pallidior*, Rly.
  b. General colour buffy ("écru drab"). 4. *m. dunni*, Thos.

DISTRIBUTION :—

1. *M. meltada meltada,* Gray.	*Type locality* :—"Dharwar" (Elliot). *Other localities* :—Nasik; Ahmednagar; Dharwar; Madras (B. M.); Cutch; Kathiawar; Khandesh; Nimar; Central Provinces; Dharwar; Coorg; Ceylon (M. S. I.). *Co-Types* :—B.M. Nos. 34 *a.b.* and *c.* (Type of *comberi,* Wroughton, B. M. No. 7. 1. 7. 3). *Lectotype* :—B. M. No. 34. *a.*
2. *M. meltada listoni,* Wroughton.	*Type locality* :—Kolaba Dist., Bombay Pres. (Liston). *Other localities* :—Ratnagiri (B.M.). *Type* :—B.M. No. 7. 1. 7. 6.
3. *M. meltada pallidior,* Ryley.	*Type locality* :—Lunwa, Palanpur (B. N. H. S.—Crump). *Other localities:*—Palanpur (M. S. I.) *Type* :—B. M. No. 13. 8. 23. 3.
4. *M. meltada dunni,* Thomas.	*Type locality* :—Umbala, Punjab (Major Dunn). *Other localities* :—None. *Type* :—B.M. No. 8. 3. 3. 5.

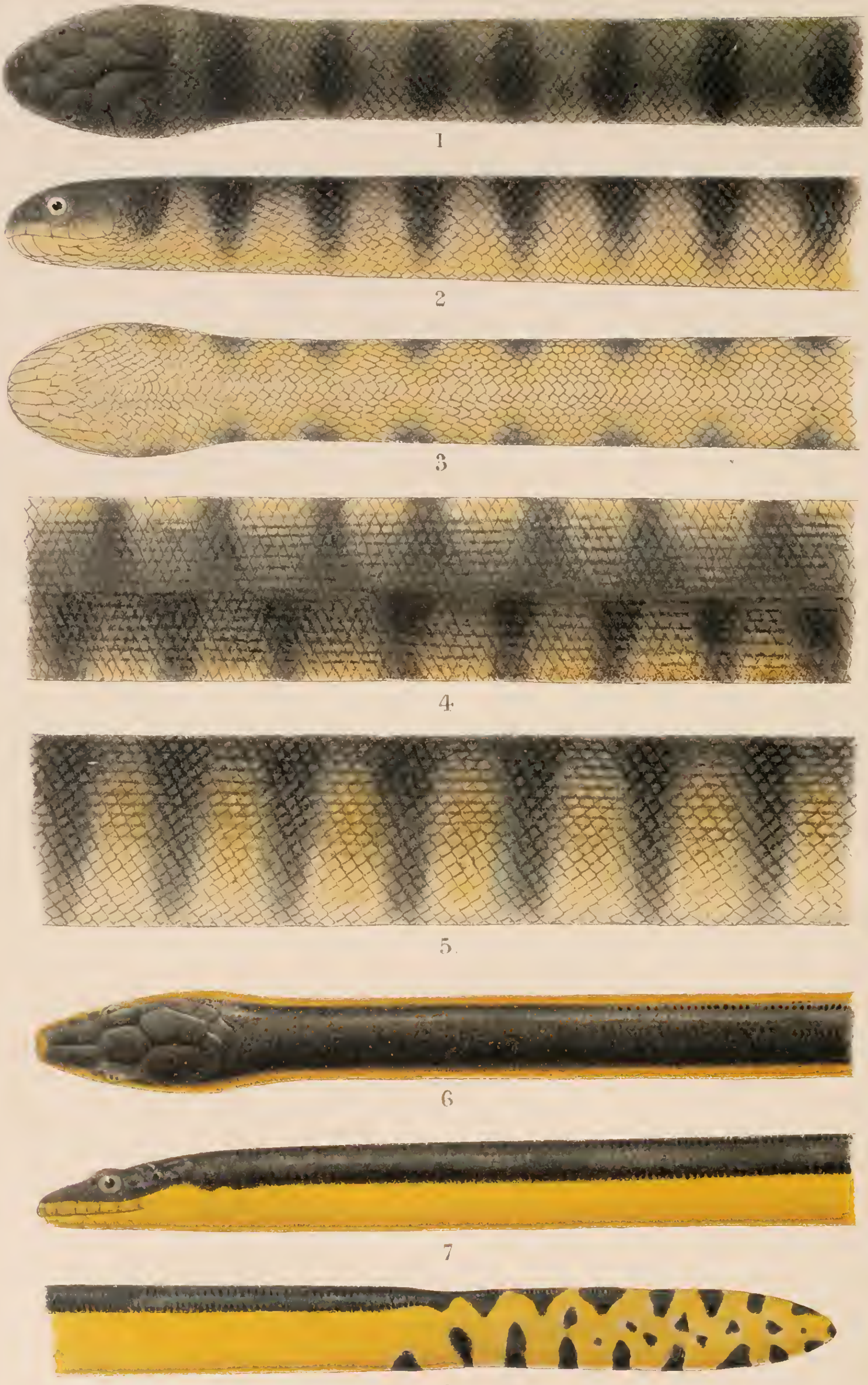
Gen. X.—GUYIA.

Thomas separated this genus from MILLARDIA (J. B. N. H. S., xxv, p. 201, 1917, for the aberrant species *kathleenæ,* Thomas (J. B. N. H. S., xxiii, p. 29, 1914), the genotype and only species.

DISTRIBUTION :—

G. kathleenæ, Thomas.	*Type locality* :—Pagan, Upper Burma (B. N. H. S.—Shortridge). *Other localities* :—Pagan; Mt. Popa (M. S. I.). *Type* :—B. M. No. 11. 1. 3. 5.

(To be continued.)



T. Gerhardt del

J. Green, Chromo

THE COMMON INDIAN SNAKES. (Wall)

1-5. Enhydrina valakadien, *poisonous.* 6-8. Hydrus platurus, var. bicolor. *poisonous.*

all nat. size.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plate and Diagrams

BY

F. Wall, C.M.G., C.M.Z.S., F.L.S., Lieut.-Colonel, I.M.S.

Part XXVIII (with Plate XXVIII and Diagram.)

(*Continued from page 437 of Volume XXVI.*)

ENHYDRINA VALAKADYN (Boie).

(*vel SCHISTOSA* (Daudin)).

The Jew's-nosed Seasnake.

History.—The type-specimen, which had previously been lost sight of, I discovered in the Royal College of Surgeons' Museum, London. It is No. 523 of their catalogue (1859, p. 78), and is the original specimen from Tranquebar figured by Russell in his second volume (plate xi). It was one of Russell's collection which was presented to the above Institution by the East India Company, most of which has since been transferred to the British Museum.

I do not concur with Boulenger in thinking plate x. of Russell's same volume a distinct species. I agree with those herpetologists, and they are many, who think that the figure on plate x represents the same species as plate xi. If this opinion is correct this snake should be known by the name *schistosa* given it by Daudin in 1803, while Boie's name *valakadyn* dating from 1827 should be suppressed. I prefer in this paper however to retain the title with which all have been familiar for so many years.

Nomenclature. (*a*) *Scientific.*—The generic name is from the Greek "en" in, and "hudor" water. The specific name is borrowed from the vernacular.

(*b*) *English.*—I would suggest "Jew's nosed Seasnake" or simply "Jew's nose." These names draw attention to a very obvious feature which is peculiar to this species.

(*c*) *Vernacular.*—According to Russell "valakadyn" is the name given to it on the Coromandel Coast, and "hoogly pattee" about Calcutta. The former is Tamil from "valla" strong and "Kadyen" biter. "Pattee," a "bandage," obviously refers to its flattened body.

General characters.—The snake is robust in habit, the forebody cylindrical, and much less constricted relatively than in many seasnakes. Posteriorly the body is very compressed and heavy, especially in gravid females. The head is large, and has a peculiar downward prolongation of the snout, and equally peculiar pronounced furrow in the chin. The tail is a flattened vertical paddle similar to that in other hydrophids.

Colour.—Very variable. The young are bluish or bluish-grey with many well defined, black annuli, often dilated vertebrally. As age advances these bands become more and more obscured, first disappearing ventrally, to become dorsal bars, which in old specimens may disappear altogether. In old adults the dorsum is frequently a uniform bluish or bluish-grey, merging at midcosta to yellow or yellowish ventrally. Both dorsal and ventral hues again are subject to much modification according to whether the specimen has recently desquamated or is about to do so. In the latter case the yellow on the belly becomes often tinged with brown.

Identification.—The downward projection of the rostral shield to below the level of the lip and the groove in the chin are both features peculiar to this species, and make identification as easy as it is certain.

The suture from the nostril passes to the 1st labial, a very unusual feature seen in only one other species, *viz.*, *Enhydris hardwicki.*

Habits.—This is far the commonest seasnake around our shores, and extraordinarily plentiful. On the Malabar Coast the fishermen brought them in bucketfuls until deterred from doing so. I have certainly had over fifty brought to me in one morning taken from their nets. On the Coromandel Coast at Madras and at Gopalpore I have seen the nets brought in with a dozen or more of these snakes among the haul. At Cannanore the men in the 75th Carnatic Infantry fishing in the sea with lines, more often it seemed to me hooked a "jew's nose" than a fish!

It frequently comes up tidal rivers, and several were captured for me at Watiya in Burma at a distance of 40 miles from the sea. It has been taken in Tolly's Nullah, Calcutta, 80 miles from the sea.

In Cannanore I kept several of these snakes in a dry masonry trough among my flower pots, where they lived many days without any water. Here they crawled about in a clumsy awkward fashion, but progression was far less hampered than is the case in the very thin necked seasnakes. All these specimens were conspicuously gentle creatures, that I failed to provoke to bite an offending object. This placid disposition is well exemplified by the fact that the sepoys and others who habitually bathed at Cannanore were never bitten, plentiful as I have shown that the "Jew's nose" is there.

The Sexes.—Females appear to be more numerous than males from the few notes at my disposal. In Cannanore of 13 specimens sexed 8 were ♀. Again of 19 fœtuses obtained in the same station 12 proved to be ♀. Except for the basal swelling in the tail in males there is nothing to distinguish the sexes. The tubercles on the scales are rather more pronounced in males than in females. Each male clasper is bifid with its extremities beset with villose papillæ. A raphé passes from the cloaca up the inner face, and then to the back of the "stalk" where it divides to pass up up each limb.

Food.—They live entirely on fishes. Speaking of Malayan specimens Dr. Annandale says: "A very large proportion of the fish on which they feed are silurids and others provided with long, sharp spines, and the manner in which these spines are eliminated from the snake's bodies is curious, for they appear to pass out through the walls of the alimentary canal and through the body wall to the exterior. I have frequently found specimens of the Hydrophinæ with fish spines actually protruding from within through the integument, without, apparently, causing any inflammation or inconvenience. Seasnakes cannot hiss, but produce a low gurgling sound when annoyed."

Breeding.—The season is only proximately known. On the 12th November 1903, in Cannanore, I had a gravid ♀ in which small eggs were discovered containing no trace of embryo. In December the same year I had a gravid mother with fœtuses, ranging from 6⅝ to 7 inches long. In January and February 1904, I had four other gravid females in which the embryos were well developed, the most advanced measuring from 10⅝ to 11 inches on January 29th. As Gunther has recorded a newly born individual 10½ inches long, the brood above referred to would probably have been born early in February.

In 1917 I had 11 specimens from Madras in June (evidently this year's offspring) which varied in length from 12½ to 17 inches. My youngest mother measured 3 feet 2 inches in January, a length I reckon (from rather meagre figures) she would have attained at the end of her 3rd year of life. My six gravid specimens contained respectively 4 fœtuses, and 5 fœtuses and 1 infertile egg, 6 eggs, 6 fœtuses, 9 fœtuses and 8 fœtuses. The young latterly are contained in transparent membranous sacs filled with a viscid fluid of the consistency of castor oil. Males before birth as usual had their genitals extruded.

Growth.—The young appear to double their length in the first year, when they are about 20 to 24 inches long. At the end of the 2nd year they are about 30 inches long, and at the end of the 3rd about 38 to 40 inches, and growth continues for some years later. Average adult specimens range between 3 and 4 feet, but I have had larger examples, *viz.*, a ♀ 4 feet 3½ with a girth of 6½ inches at its greatest thickness, and a ♂ 4 feet 7 inches long.

Food.—I have only found fish ingested.

Venom of Enhydrina.

Quality.—In its dried state Fraser and Elliot report that it consists of "thin scales of a very pale yellow colour."

Quantity.—Rogers estimated that the average amount injected during a bite represented one centigramme in the dried state. (Average from 13 specimens.) Fraser and Elliot's estimate for six specimens is much lower, but could not be stated exactly owing to an accident.

Toxins.

(1) Neurotoxins operating on nerve cells.
  (*a*) A depressor paralysing the respiratory centre (Rogers, Fraser and Elliot).
  (*b*) A depressor paralysing centres in the bulb (Inferred from the remarks of Rogers, Fraser and Elliot).
  (*c*) A depressor paralysing nerve endings, the phrenics especially (Fraser and Elliot).
(2) A direct stimulant to cardiæ muscle (or nerve endings). Very feeble (Fraser and Elliot).
(3) Toxins affecting the constitution of the blood.
  (*a*) Hæmolysin. Very feeble (Fraser and Elliot).

Analysis of the action of Enhydrina toxin.

(1) (*a*) The "neurotoxin" paralysing the respiratory centre is the chief agent in producing death. It is powerfully assisted by (1) (*c*).
  (*b*) This neurotoxin evokes symptoms of paralysis of the lips, tongue, throat and voice.
  (*c*) This assists (1) (*a*) in arresting breathing.
(2) This is so feeble in action as to be altogether a negligible factor in the toxæmia.
(3) (*a*) This affects the blood so little that hæmorrhages are not likely to be seen.

Symptoms of Enhydrina poisoning.

These have only been studied on lower animals in the laboratory. Rogers says there is no difference between the toxic manifestations of this species and the cobra.

Fraser and Elliot, however, have pointed out that there is much greater respiratory embarrassment with Enhydrina venom than cobra venom, and this is accounted for by the fact that in Enhydrina poisoning the heart and blood vessels are practically unaffected by any direct action of the venom, whereas in cobra toxæmia both are markedly affected. Again the paralysis of the end plates of the phrenic nerves is more pronounced than in cobra poisoning.

In the human subject then one would expect a clinical picture such as I have portrayed in my article on the cobra (Part XX of these papers, Vol. 22, p. 243). Over and above this, one would expect a greater degree of respiratory embarrassment. Hæmorrhages are not so likely to occur and the local effects according to Lamb are slight. Death, as in other Colubrine toxæmiæ, is due to a paralysis of the respiratory centre.

Treatment.—Fraser and Elliot have shown that Calmette's antivenene has a very feeble action in neutralising the effects of the poison, so that this agent or the Kasauli preparation may be tried. Otherwise treatment should be symptomatic, and on the lines laid down in my book (Pois. Terr. : Snakes. 1913, p. 145).

Lethal dose.—The minimal lethal dose for rats was found to be ·00009 grammes of dried venom per kilogramme weight of the rodent. In rabbits the dose was ·00006 grammes and in cats, the least susceptible of the three animals experimented with, ·0002 grammes.

Distribution.—Around all our coasts from the Persian Gulf to Tenasserim, the Malayan Region and as far East as New Guinea. At Cannanore though I have no figures to support me I judge that I got at least ten specimens for every one of all other species put together. In Madras in 1917, out of a collection of 199 seasnakes, 60 proved to be of this species. Though I have frequently witnessed the drawing in of the huge nets (perhaps a mile long) the fishermen use in Ceylon, I very rarely saw any seasnake captured, and never this species. I can find no record of it from the Andaman Islands though very common on the Coast of Burma.

Lepidosis.—*Rostral.*—Rather deeper than broad, projecting below the level of the lip. *Nasals.*—In contact behind the rostral; the suture from the nostril passes to the 1st labial. *Præfrontals.*—Usually touch the 2nd labial (in rare instances the præoculars meet the nasals). *Frontal.*—The parietal sutures are equal to the supraoculars or sometimes slightly longer. *Supraoculars.*—Usually as long and as broad as the frontal. *Præocular.*—One. *Postoculars.*—One or two. *Temporals.*—One, large, nearly descending to the lip, often divided into two. *Labials.*—7 to 8; the first 4 usually entire, the 3rd and 4th touching the eye. *Infralabials.*—5, the 5th in contact with 3 or 4 scales behind. *Marginals.*—None. *Sublinguals.*—Absent. Two small pairs both widely separated by small scales are regarded by some as such. *Costals.*—Two headslengths behind the head 47 to 61, at greatest girth 50 to 70 : imbricate or subimbricate everywhere; furnished with keels occupying the median $\frac{1}{3}$ to $\frac{3}{5}$ of each scale, and frequently twice or thrice denticulated. The keels and their denticulations are most pronounced on the belly, especially in males which may be very rough in consequence. In females and young the keels are less obvious, or even obsolescent. This condition resembles very closely that seen in *H. cyanocinctus*, and *coronatus*. *Ventrals.*—230 to 361; little broader than the last costal rows; often divided; laterally keeled as in the last costal rows.

Dentition,—Maxilla.—Two fangs and 3 to 5 small teeth behind *Palatine*—5 to 6. *Pterygoid*—15 to 16. *Mandible*—16.

HYDRUS PLATURUS (LINNE).

LINNÉ'S SEASNAKE.

History—Described by Linné in 1766. Figured by Russell in 1796 on the XLI plate of his 1st volume.

Nomenclature.—(*a*) *Scientific*—The generic name is from the Greek "udor" water, the specific from the Greek "platys," flat, and "oura," tail.

(*b*) *English.*—Linné's seasnake.

(*c*) *Vernacular.*—According to Fayrer this snake is called "kullundur" by natives about Puri.

General characters.—It is the most eel-like of all the marine forms. The head is relatively large, and depressed, and the snout unusually long. The body anteriorly is not nearly so constricted as in many seasnakes, and is compressed. The back is sharply ridged. The tail is a vertical paddle as in other seasnakes.

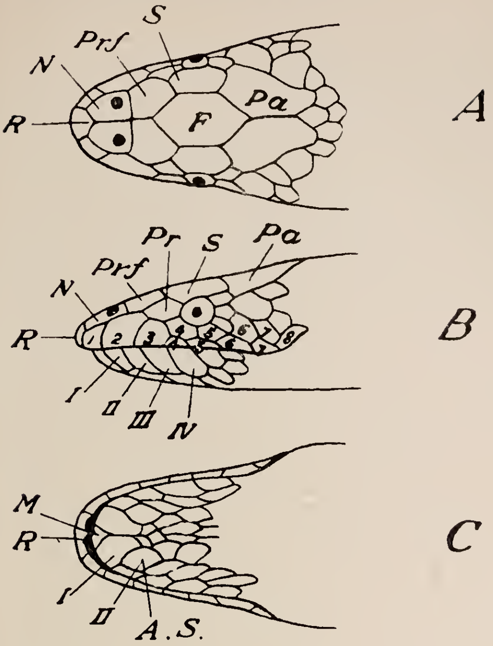
Identification.—The scale rows anteriorly (40 to 54) are unusually numerous for a marine species, and there are no marginals. Only one other species, *viz.*, *E. valakadyn*, agrees in these respects, and this is known by the downward projecting rostral, the groove in the chin, and the suture running from the nostril to the 1st labial, all features not seen in *H. platurus*. Osteologically it differs from the other marine species in that the præfrontal bones do not meet the parietal or postfrontals, and in the possession of a subparietal crest or keel. The snake, however, is very distinctively marked and once seen could hardly be mistaken for any other.

Colouration.—There are several colour varieties which may be grouped as follows.

Variety (*A*) (= the *bicolor* of Schneider, and variety E of Boulenger's Catalogue, Vol. III, p. 268). Head chocolate or black above, yellow beneath. Body with a broad stripe dorsally of the same colour as the head. The lower edge of the stripe is straight, and sharply demarcated from the pale yellow of the sides and belly. Tail with black dorsal bars, and lateral spot.

This is by far the commonest variety on our coasts. Some specimens have a series of black costal spots in the yellow, or these may be confluent and form a more or less irregularly-outlined stripe. (Variety C of Boulenger's Catalogue.) Such specimens are not infrequent.

I have seen specimens in the Indian Museum from Ceylon and Puri. A specimen in the Bombay Natural History Society's collection from Madras, and another in the Indian Museum from the Nicobars, have the posterior part of the dorsal stripe festooned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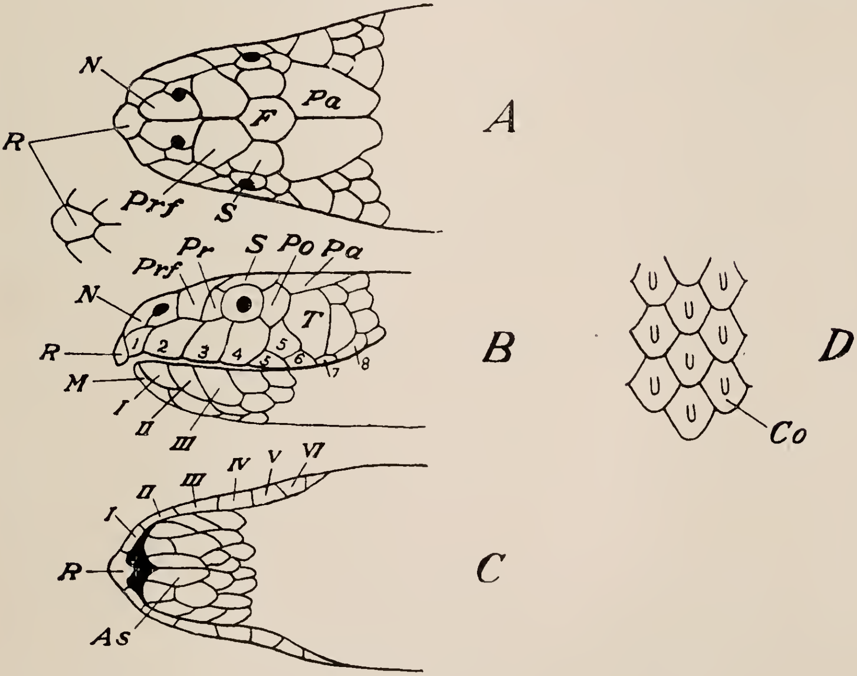
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Enhydrina valakadyn

A.B.C. nat. size $D \times \frac{2}{1}$

COMMON INDIAN SNAKES.

instead of straight, and thus constitute a form transitional between Varieties A and B.

Variety (*B*) (= the *ornata* of Gray, the *maculata* of Jan, and Varieties A and B of Boulenger's Catalogue). In this the dorsal stripe is broken up into cross-bars in the whole body length, or for a variable extent posteriorly and a series of spots costally alternates with the bars. It is a rare form known from Borneo, but dubiously from our coasts.

Variety (*D*) (= Variety D of Boulenger's Catalogue). Like Variety A, but the yellow is replaced by a khaki hue. In some the hues are separated by a yellow line. I saw three such with a yellow line from Ceylon in the Colombo Museum, and there is one from Bombay in the British Museum. One without the yellow line in the Indian Museum is from Travancore, and there is another in the Colombo Museum from Ceylon.

Variety (*E*) (= Variety G of Boulenger's Catalogue). The name *pallidus* would suit this form. It differs only from Variety A in that the sides and belly are whitish or greyish, and the dorsal stripe and caudal marks are much paler than normal, indeed these may be almost obsolescent. Such a specimen from Travancore is in the British Museum. Probably a specimen I saw in the Colombo Museum from Ceylon, another in the Indian Museum from the Persian Gulf, and a third in the Bombay Natural History Society's collection from Bombay, all of which I took at first to be very faded specimens, belong to this variety. The last is so pale, and the vertebral stripe so extremely indistinct; I regarded it dubiously as an albino. Father Dreckman in 1913 wrote to me of a somewhat similar specimen he had recently acquired near Bandora on the Bombay coast. This was a light grey colour with a somewhat darker vertebral stripe. The tail had the usual characteristic black marks.

Breeding.—As far as I am aware no breeding events have been published, and I have never seen a gravid specimen myself. It is probably viviparous in habit like other sea snakes.

Poison.—In "Land and Water" (Nov. 15th, 1879) is an account of one that climbed up the anchor chain of a man-of-war in the Ganges. An unfortunate midshipman who tried to capture it was bitten and died shortly afterwards.

Ectozoa.—Both Dr. Annandale and Dr. Willey, among others, have remarked upon barnacles that attach themselves to this snake. Dr. Annandale mentions *Conchoderma hunteri* as one species, and Dr. Willey published an excellent plate of this snake with a cluster of Barnacles of two species, *viz.*, *C. hunteri* and *Lepas anserifera* clinging to the tail (Spolia Zeylanica, 1906, p. 207, and 1910, p. 180). These creatures are not parasites, frequently clinging to inanimate objects. When attached to snakes they furnish an example of commensalism.

Length.—This is a small snake, specimens exceeding two feet being unusual. The largest measurement I know is 2 feet, 3½ inches.

Lepidosis.—*Rostral.*—Broader than high. *Nasals.*—In contact behind the rostral. There is usually no suture from the nostrils, but when present it passes to the 2nd labial. *Præfrontals.*—Usually touch the 2nd labial, but sometimes they are cut off by the apposition of the præocular and nasal. *Frontal.*—The parietal sutures are equal to, or little longer than the supraocular. *Supraoculars.*—In length and breadth about three-quarters that of the frontal. *Præocular.*—One, rarely two. *Postoculars.*—Two, or sometimes three. *Temporals.*—Two or three small scales hardly deserving the name of temporals lie between the parietals and the 6th labial. *Labials.*—7 to 9 ; the first 3 usually entire, many of the succeeding frequently divided; the 4th, 5th, and 6th usually touching the eye. *Infralabials.*—5, the 5th largest, and touching 3 or 4 scales behind. *Marginals.* Absent. *Sublinguals.*—Small, but usually descernible as such ; the fellows of both pairs separated by several scales. *Costals.*—Two headslengths behind the head 40 to 54, at greatest girth 41 to 55 ; juxtaposed everywhere. Each scale has a pair of small round tubercles in the middle, one behind the other, which are very characteristic. (A similar feature is only seen in two other seasnakes, *viz.*, *H. gracilis* and *H. cantoris.*) These tubercles are very pronounced in males, especially on the lowest costal rows, and give the snake a rough rasp-like feel. At or about midcosta the tubercles become single, and dorsally may be obsolescent, especially in females and young. *Ventrals.*—284 to 339 ; small, not or hardly broader than the last costal row, but usually recognisable as such, and countable ; bituberculate laterally as in the lowest costal rows.

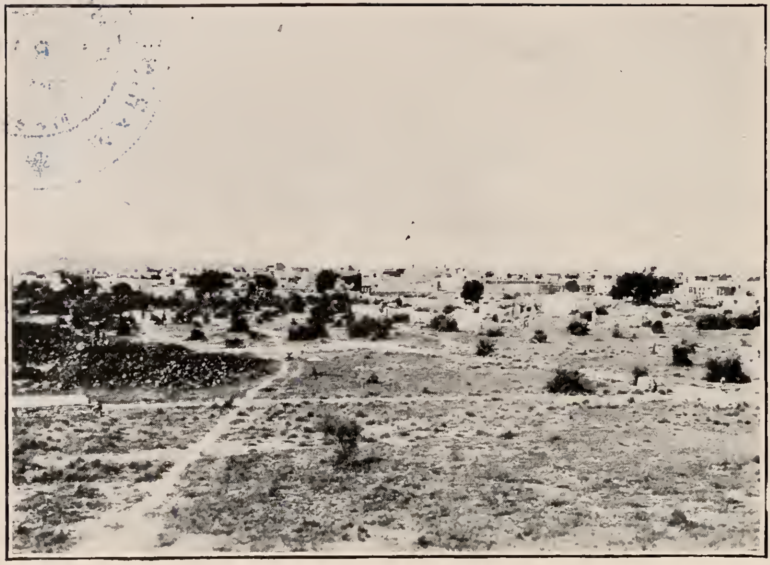
Distribution.—Persian Gulf to Tenasserim and the Andamans. Beyond Indian limits it has a very wide range extending to Japan, Australia, New Zealand, South Africa, and the Western Coast of North America.

Not uncommon on our shores. Ferguson speaking of Ceylon remarks that it is common about Colombo, and at the pearl fisheries.

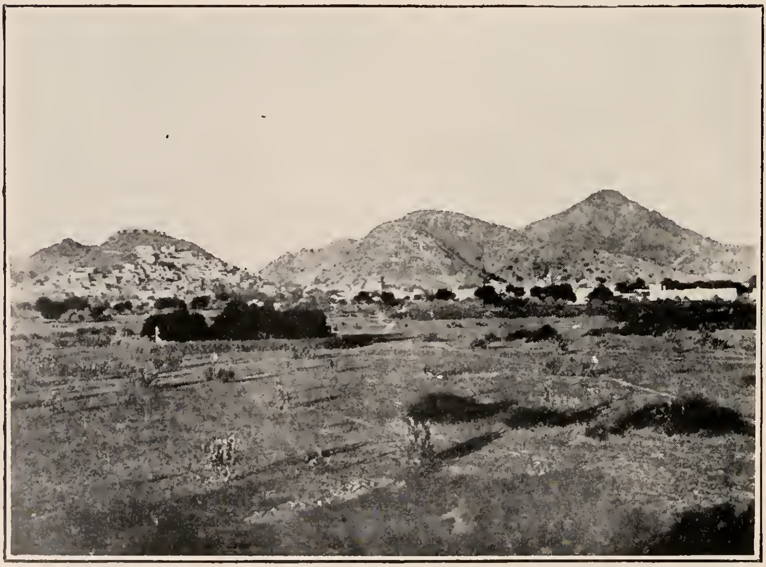
Dentition.—*Maxilla.*—The upper jaw bears from 8 to 10 teeth behind the fangs. *Palatine* 6 to 7. *Pterygoid.* 23 to 27. *Mandibular* 16 to 18.

Plate.—Our figure shows a good illustration of Variety *bicolor* of Schneider.

(*This series of Popular Articles is now concluded.*)



A.—View of Phalodi (Jodhpur State), taken from the Rest House.



B.—View of Barmer (Jodhpur State) and neighbouring hills.

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THE FLORA OF THE INDIAN DESERT. (JODHPUR AND JAISALMER).

BY

E. Blatter, S.J., and Prof. F. Hallberg.

Part III.

With 6 plates.

(*Continued from page* 551 *of Vol. XXVI.*)

Acanthaceæ.

Blepharis Juss.

Blepharis sindica, T. Anders. in Journ. Lin. Soc. IX (1867) 500.

Vern. N.: Bhongri.

Loc.: Jodhpur: Jodhpur (No. 9130!), Mandor (No. 9142!), Osian (No. 9134!), Balarwa (No. 9144!, 9144!), Bhikamkor (No. 9132!), Phalodi (No. 9136!), near Bhadka, gravel and rocks (No. 9141!), Barmer (No. 9133!). Jaisalmer: Shihad (No. 9129!), near Loharki (No. 9138!) near Jaisalmer (No. 9131!), Amarsagar (No. 9135!), Devikot (No. 9139!), Vinjorai (No. 9140!).

Distrib.: Punjab, Rajputana, Sind, Gujarat.

Fl. and fr. in October and November.

Uses: The plant is boiled in milk and taken as a tonic. It is given to cattle for greater milk production.

Ruellia L.

Ruellia patula, Jacq. Misc. Bot. II (1781) 358, *var. alba* Saxton in Rec. Bot. Surv. Ind. VI (1918) 288.

Loc.: Kailana (No. 9110!), Kailana rocks (No. 9111!), Mandor (No. 9112!), Kotda near Seu (No. 9113!), Barmer rocks (Nos. 9114, 9115!). Jaisalmer: Vinjorai (No. 9109!).

Distrib.: The type extends from India to tropical Africa. The variety has been found by Saxton in N. Gujarat.

Fl. and fr. in October and November.

Andrographis Wall.

Andrographis echioides, Nees in Wall. Pl. As. Rar. III (1832) 117.

Vern. N..: Goondlu (Macadam).

Loc.: Jodhpur: Bori Mera (No. 9162!), found occasionally about Jodhpur, but not common (Macadam).

Distrib: Tropical India, Ceylon.

Fl. and fr. in October.

Barleria L.

Barleria prionitis, L. Sp. Pl. (1753) 636, *var. diacantha var. nov.*—Altitudine 150 cm. attingens, formans frutices densos. Florum spicæ 15 cm. attingentes, bracteolis 3 cm. longis spinosis albis. Calycis lobus anterior bispinosus, posterior spina simplici.

Loc.: Jodhpur: Barmer (No. 9165!), on rocky hillsides.

Barleria acanthoides, Vahl Symb. I (1790) 47.

Vern. N.: Chapri, in Jaisalmer, Damasha in Jodhpur (Macadam).

Loc. : Jodhpur: Kailana, on rocks (Nos. 9166 !, 9167 !, 9168 !). Jaisalmer: Amarsagar on rocks (Nos. 9169 !, 9170 !), Bada Bag on rocks (No. 9171 !), Vinjorai (No. 9172 !).

This plant is common on rocks near Jodhpur and Jaisalmer. Macadam found it in "dry and sandy places". All our specimens were gathered in rocky localities.

Distrib. : India, Baluchistan, Abyssinia, Nubia, Egypt.

Fl. and fr. in October and November.

NOTE :—This plant is very variable with regard to the mucro of the leaves and outer sepals, the division of the spines in the bracts and bracteoles, and, finally, the length of the corolla. In general, the mucro of the leaves is stronger, that of the outer sepals weaker than in Sind specimens. The sepals are sometimes without mucro.

Barleria hochstetteri, Nees in DC. Prodr. XI (1847) 231.

Loc. : Jodhpur: Barmer (No. 9163 !), Barmer on rocks (No. 9164 !).

Distrib. : Rajputana, Sind, Baluchistan, Arabia, Nubia, Abyssinia.

Fl. and fr. in November.

NOTE :—King mentions *Barleria noctiflora* L. as occurring in Western Rajputana. As this species has been observed in the Nilgherries only and in Ceylon, we are justified in doubting the identification of King's plant.

Lepidagathis Willd.

Lepidagathis cristata, Willd. Sp. Pl. III (1800) 400.

Vern. N. : Patta fori in Jodhpur; Bhangri in Jaisalmer (Macadam).

Loc. : Not uncommon in sandy places of Jodhpur and Jaisalmer (Macadam). We have not seen this species.

Lepidagathis trinervis, Nees in Wall. Pl. As. Rar. III (1832) 96.

Vern. N. : Unt Katala (Macadam).

Loc. : Jodhpur : Kailana on rocks (Nos. 9128 !, 9127 !). Bhikamkor (No 9126 !).

Distrib. : India.

Fl. and fr. in October.

NOTE :—In naming this plant we have followed Cooke, although our plants do not exactly agree with his description. There are also differences between our specimens and the description in Hook. Fl. Brit. Ind. Until more material is available we retain the above name.

Uses : The hairy mucilaginous seeds, soaked in cold water, form a cooling drink (Macadam).

Justicia L.

Justicia micrantha, Heyne ex Wall. Cat. (1828) 2449.

Loc. : Jodhpur: Sutlana (No. 9160 !). Jaisalmer: Bada Bag (No. (9161 !).

Distrib. : India.

Fl. and fr. in October and November.

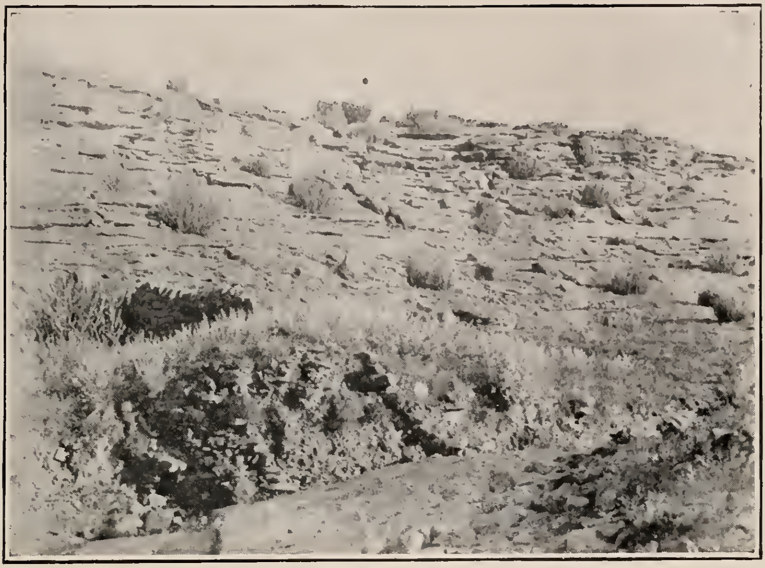
NOTE :—The leaves of No. 9161 are unusually large. The fact that the plant was growing in a well-watered garden, may explain this.

Justicia simplex, D. Don Prodr Fl. Nep. (1825) 118.

Loc. : Jodhpur : Kailana (Nos. 9146 !, 9147 !), Balarwa (No. 9148 !), Osian (Nos. 9149 !, 9150 !), near Badka (No. 9151 !), Kotda (No. 9158 !), Barmer sand (No. 9152 !). Jaisalmer: Shihad (Nos. 9153 ! , 9154 !), Amarsagar (No. 9155 !), Vinjorai (No. 9156 !), Vinjorai on rocks (No. 9157 !).

Distrib. : Abyssinia, India, Malay Islands.

Fl. and fr. in October and November.



A.—A Rocky Valley above Mandor (Jodhpur State). On the terraced slope: *Euphorbia neriifolia*. In the foreground: a belt of *Aerua tomentosa*, below it *Lepidagathis trinervis* and *Fagonia cretica*.

B.—A field at Balarwa (Jodhpur State), invaded by *Leucas aspera*.

Justicia procumbens, L. Sp. Pl. (1753) 15.
Vern. N. : Gungi bunti, mokra ghas, kagner (Macadam).
Loc. : Jodhpur : Common along the roadsides about Jodhpur and in cultivated places (Macadam). We have not seen this species though Macadam calls it common about Jodhpur.
Distrib. : India, Ceylon, Malaya, Australia.

Peristrophe Nees.

Peristrophe bicalyculata, Nees in Wall. Pl. As. Rar. III (1832) 113.
Vern. N. : Kagner (Macadam).
Loc. : Jodhpur : Balsamand (No. 4009 !), Kailana (No. 9122 !), Osian (Nos. 9117 !, 9118 !), Phalodi (No. 9119 !), Kotda near Seu, on gravel and sand (No. 9120 !), Barmer rocks (No. 9121 !). Jaisalmer: Amarsagar (No. 9124 !), Devikot (No. 9125 !).
Distrib. : India, trop. Africa.
Fl. and fr. in October and November.

VERBENACEÆ.

Lippia L.

Lippia nodiflora, Michaux Fl. Bor. Amer. II (1803) 15.
Loc. : Jodhpur : Kailana (No. 10365 !), Balsamand (No. 10366 !).
Distrib. : Most tropical and subtropical regions.
Fl. and fr. in October.

Bouchea Cham.

Bouchea marrubifolia, Schauer in DC. Prodr. XI (1847) 558.
Vern. N. : Bui.
Loc. : Jodhpur : Kailana rocks (Nos. 10374 !, 10375 ! , 10376 !), Bhikämkor (No. 10377 !), Kotda near Seu, rocks (No. 10378 !), Barmer rocks (No. 10379 !). Jaisalmer: near Bap (Nos. 10383 !, 10381 !), Loharki, rocks and gravel (No. 10380 !), Jaisalmer, rocky plateau (No. 10382 !), near Devikot (No. 10384 !), Vinjorai, sandy plain (No. 10385 !).
Distrib. : Trop. Africa, Abyssinia, Egypt, Arabia, Sind, Rajputana.
Fl. and fr. in October and November.

Vitex L.

Vitex negundo, L. Sp. Pl. (1753) 638.
Vern. N. : Samala (Macadam).
Loc. : Jodhpur : Balsamand (No. 10373 !).
Distrib. : Afghanistan, India, Ceylon, Philippines.
Fl. in October.
Uses : An infusion of the seeds is used for rheumatism of the joint (Macadam).

Clerodendron L.

Clerodendron phlomidis, L. f. Supp. (1781) 292.
Vern. N. : Arni, yerna.
Loc. : Osian (No. 10367 !), near Badka (Nos. 10372 !). Jaisalmer : near Bap (Nos. 10368 ! , 10369 !), Vinjorai (No. 10370 !) , Devikot (No. 10371 !).
Distrib. : India, Ceylon.
Fl. and fr. in October and November.
Uses: Eaten by camels. The leaves are applied locally against guinea worm.

LABIATÆ.

Ocimum L.

Ocimum sanctum, L. Mant. I (1767) 85.
Loc.: Jodhpur: Kailana (No. 10413!). Jaisalmer: Bap (No. 10411!), Amarsagar (No. 10412!). Cultivated.
Fl. and fr. in November.

Ocimum canum, Sims in Bot. Mag. (1824).
Vern. N.: Bapji (Macadam).
Loc.: Jodhpur: Phalodi (No. 10416!).
Distrib.: Tropics of the Old World.
Fl. and fr. in October.
Uses: The seeds are drunk in milk as a tonic, and a decoction of them with potash in water is used as a cooling drink in fever. A bunch of the plant hung in the corner of a room is said to attract mosquitoes and keep the rest of the room free from them (Macadam).

Ocimum basilicum, L. Sp. Pl. (1753) 597.
Loc.: Bhikamkor (No. 10414!), Barmer (No. 10415!).
Fl. and fr. in October and November.

Leucas R. Br.

Leucas urticæfolia, R. Br. Prodr. (1810) 504.
Loc.: Jodhpur: Jodhpur (No. 10392!), Jodhpur Fort (No. 10393!), Balarwa (No. 10394!), Bhikamkor (No. 10395!), Kotda (No. 10396!), Barmer (No. 10398!). Jaisalmer: Bap (No. 10399!), Bada Bag (No. 10400!), Devikot (No. 10401!), Vinjorai, wet ground (No. 10402!).
Distrib.: Abyssinia, Arabia, Baluchistan, India.
Fl. and fr. in October and November.

Leucas aspera, Spreng. Syst. II (1825) 743.
Loc.: Mandor (No. 10407!), Balarwa (Nos 10408!, 10409!).
Distrib.: Indo-Malaya.
Fl. and fr. in October.

Leucas cephalotes, Spreng. Syst. II (1825) 743.
Loc.: Jodhpur: Jodhpur (No. 10405!), Mandor (No. 10404!).
Distrib.: India, Afghanistan.
Fl. and fr. in October.

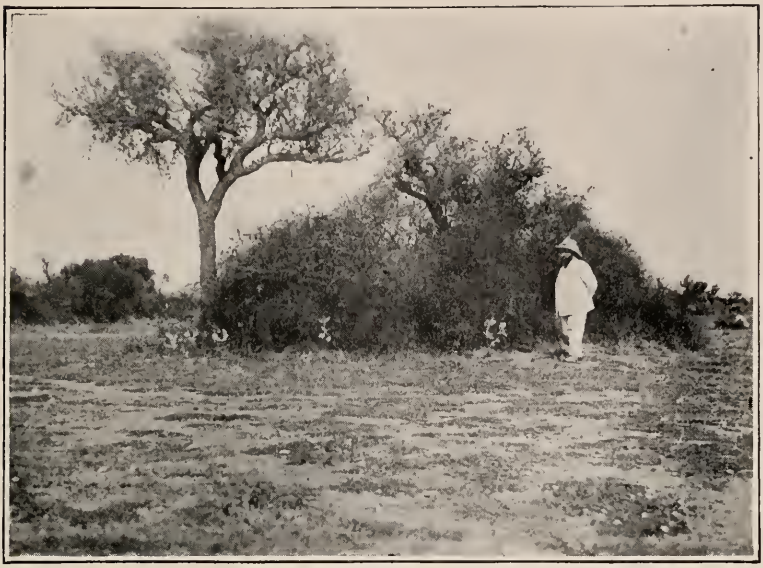
Leucas nutans, Spreng. Syst. II (1825) 743.
Loc.: Jodhpur: Balarwa (No. 10406!).
Distrib: India.
Fl. and fr. in October.

Leucas stricta, Benth. in Wall. Cat (1828) 2045.
Loc.: Jodhpur: Balarwa (No. 10410!).
Distrib.: India.
Fl. and fr. in October.

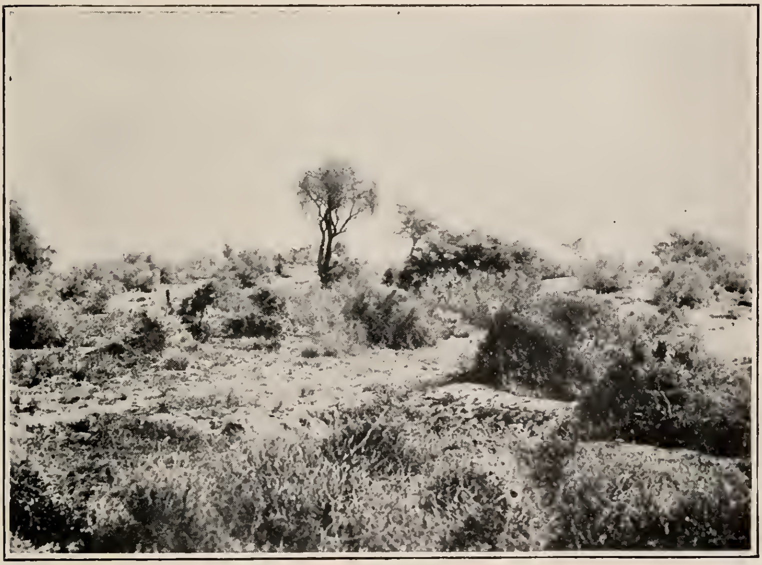
Salvia L.

Salvia ægyptiaca, L. Sp. Pl. (1753) 23.
Loc.: Jodhpur: Jodhpur (No. 10386!), Kailana (10387!), Balarwa (No. 10388!), Osian (No. 10389!). Jaisalmer: Shihad (No. 10390!).
Distrib: Mediterranean, W. Asia, Afghanistan, India.
Fl. and fr. in October.

Salvia ægyptiaca var pumila, Hook. f. Fl. Brit. Ind. IV (1885) 656.
Loc.: Jodhpur: Mandor (No. 10391!).
Distrib.: India, Afghanistan, Baluchistan.
Fl. and fr. in October.



A.—Gravel vegetation near Balarwa (Jodhpur State). Sand-binding plants in the foreground; in the background: *Capparis decidua*, *Prosopis spicigera*.



B.—Scrub at Bhikamkor (Jodhpur State). *Capparis decidua*, *Gymnosporia montana*, *Lycium barbarum*, *Zizyphus rotundifolia*, *Prosopis spicigera*, *Calligonum polygonoides*, *Crotalaria burhia*, *Tephrosia purpurea*, *Aerua*, sp.

NYCTAGINACEÆ.

Bœrhaavia L.

Bœrhaavia diffusa, L. Sp. Pl. (1753) 3.—*B. repens* L.; Hook. f. Fl. Brit. Ind. IV, 709 cum varietatibus *procumbens* et *diffusa*.

Loc.: Jodhpur: Jodhpur (Nos. 5869!, 5870!), Kailana (No. 5827!), Mandor (Nos. 5852!, 5871!), Phalodi (No. 5856!), Osian (Nos. 5836!, 5840!, 5850!), Bhikamkor (Nos. 5847!, 5846!, 5844!, 5860!), Barmer, sand (No. 5872!), near Badka (No. 5867!), Jaisalmer: Amarsagar (Nos. 5841!, 5848!, 5844!), North of Jaisalmer (No. 5838!), Jaisalmer (No. 5862!), on sand (No. 5845!), Jaisalmer on rocky plateau (No. 5837!), Phalodi to Bap (No. 5853!), near Bap (No. 5855!), Sodakoer, dried-up river bed (No. 5866!), Shihad (No. 5863!), Loharki (No. 5854!), near Loharki (No. 5859!), Bap (No. 5868!), Devikot (No. 5849!), Vinjorai, gravel (No. 5865!), Vinjorai, sandy plain (No. 5861!).

Distrib.: Tropical and subtrop. Africa, Asia, and America.

Fl. and fr. in October and November.

NOTE:—It is impossible to retain the varieties proposed by J. D. Hooker. We have tried to classify our rich material under certain groups, but we did not succeed. If we take the extreme forms we are easily tempted to regard them as distinct species; but the numerous transition forms make it necessary to unite them all under one species.

Uses: The ashes of the leaves taken in water are said to be good against night-blindness. The roots, crushed and boiled, are considered to serve the same purpose.

Bœrhaavia verticillata, Poir Encycl. Meth. V (1804) 56.

Loc.: Jodhpur: Jodhpur Fort (No. 5858!), Mandor (No. 5857!), Osian (Nos. 5839! 5830!), Barmer (No. 5877!). Jaisalmer: Amarsagar (No. 5879!), Jaisalmer, rocky plateau (Nos 5833! 5834!), Jaisalmer (No. 5878!), North of Jaisalmer (No. 5832!), Vinjorai, dunes (No. 5880!), Devikot (No. 5876!).

Distrib.: From W. India and the Punjab to Trop. Africa.

Fl. and fr. in October and November.

Bœrhaavia elegans, Choisy in DC. Prodr. XIII, part 2 (1849) 453.

Loc.: Jaisalmer: North of Jaisalmer (No. 5831!), Jaisalmer rocks (No. 5875!), between Phalodi and Bap, in a field (No 5829!), near Loharki (No. 5881!), Vinjorai sand (No. 5882!), Vinjorai rocks (No. 5874!).

Distrib.: Punjab, Sind, Baluchistan, S. Arabia.

Fl. and fr. in November.

AMARANTACEÆ.

Celosia L.

Celosia argentea, L. Sp. Pl. (1753) 205.

Vern. N.: Mokmal, Amarti (= everlasting) (Macadam).

Loc.: Jodhpur: Bhikamkor (No. 9048), Balarwa (No 9047!), not uncommon about gardens, Jodhpur (Macadam), Barmer on rocks (No. 9049!).

Distrib.: Throughout the tropics.

Fl. and fr. in October and November.

Digera Forsk.

Digera arvensis, Forsk. Fl. Ægypt. Arab. (1775) 65.

Loc.: Jodhpur: Osian (No. 9042!), Phalodi (No. 9044!), Barmer sand (No. 9039!). Jaisalmer: between Phalodi and Bap (No. 9045!), Shihad (No. 9007 !), near Loharki (No. 9041 !), Vinjorai sandy plain (No. 9043 !), Amarsagar (No. 9040 !).

Distrib. : N. Africa, Arabia, Afghanistan, Baluchistan, India, Ceylon.

Fl. and fr. in October and November.

Amarantus L.

Amarantus spinosus, L. Sp. Pl. (1753) 991.

Loc. : In many places of Eastern Jodhpur.

Distrib. : In many tropical countries.

Amarantus paniculatus, L. Sp. Pl. (1763) 1268.

Loc. : Jodhpur Fort (No 9014 !).

Distrib. : Cultivated or an escape in Africa and Asia.

Amarantus gangeticus, L. Syst. Nat ed. 10 (1759) 1268.

Loc. : Jodhpur : Mandor (No. 9012 !), Phalodi (No. 4016 !). Jaisalmer; Jaisalmer (No. 9013 !), N. of Jaisalmer, wet ground (No. 9071 !).

Distrib. : In the tropics generally.

Amarantus gangeticus var. tristis, Prain Beng. Pl. 869.

Vern. N. : Chandela.

Loc. : Jodhpur : Bhadka (No. 9011 !).

Uses : Used against stomach ache in children.

Amarantus viridis, L. Sp. Pl. (1763) 1405.

Loc. : Jodhpur : Jodhpur (No. 5982 !). Jaisalmer : Jaisalmer (No. 9009 !), Amarsagar (No. 9010 !).

Distrib. : All tropical countries.

Fl. and fr. in October and November.

Amarantus blitum L. *var oleracea*, Hook f. Fl. Brit. Ind. IV. (1885) 721.

Loc. : Jodhpur : Balarwa (No. 9016 !), Phalodi (No. 9017 !), Seu (No. 9015 !).

Distrib. : Cultivated in warm and tropical countries.

Fl. and fr. in October and November.

Amarantus polygamus, L. Amœn. Acad. IV (1759) 294.

Loc. : Jodhpur : Jodhpur (No. 9050 !), Balsamand (Nos. 9025 !, 9024 !), Balarwa (Nos. 9032 !, 9031 !), Bhikamkor (Nos. 9019 !, 9018 !), Phalodi (No. 9025 !), Barmer, (No. 9034 !). Jaisalmer : Bap (No. 9027) !), Shihad (No. 9029 !), Amarsagar (Nos. 9033 !, 9023 !), Jaisalmer (Nos. 9070 ! , 9028 !), Devikot (No. 9022 !), Vinjorai (No. 9021 !), Vinjorai, sandy plain (No. 9020 !).

Distrib. : Most hot countries.

Fl. and fr. in October and November.

Ærua Forsk.

Ærua tomentosa, Forsk. Fl. Ægypt. Arab. CXXII and 170 (=*Ærua javanica* Wight).

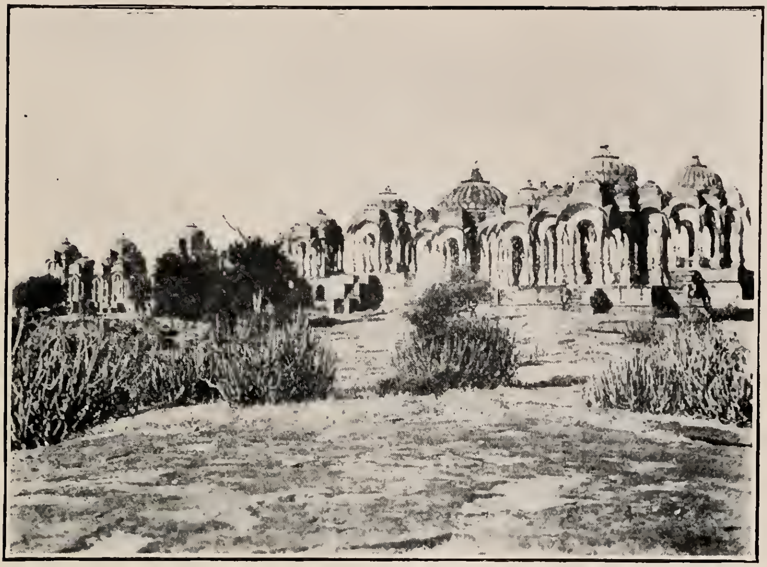
Vern. N. : Bui (Macadam).

Loc. : Jodhpur : Osian (No. 5953 !), Bhikamkor (Nos. 5977 ! , 9075 !), Phalodi (Nos. 5961 !, 9072 !), near Bhadka (No. 9073 !), Barmer (No. 5978 !), Jaisalmer : Sodakoer sandy plain (No. 5958 !), Sodakoer river bed (No. 9074 !), Loharki (No. 5975 !), Jaisalmer. rocky plateau (No. 5981 !), Amarsagar (No. 5960 !), Devikot (No. 5966 !), Vinjorai (Nos. 5956 !, 5957 !).

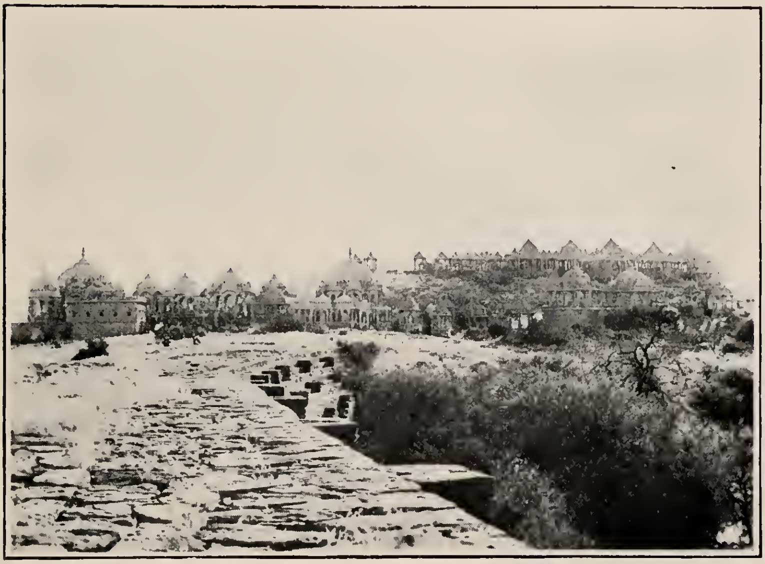
Distrib. : Cape Verd Islands, E. and W. trop. Africa, N. Africa, Arabia, India, Ceylon (not Java).

Fl. and fr. in October and November.

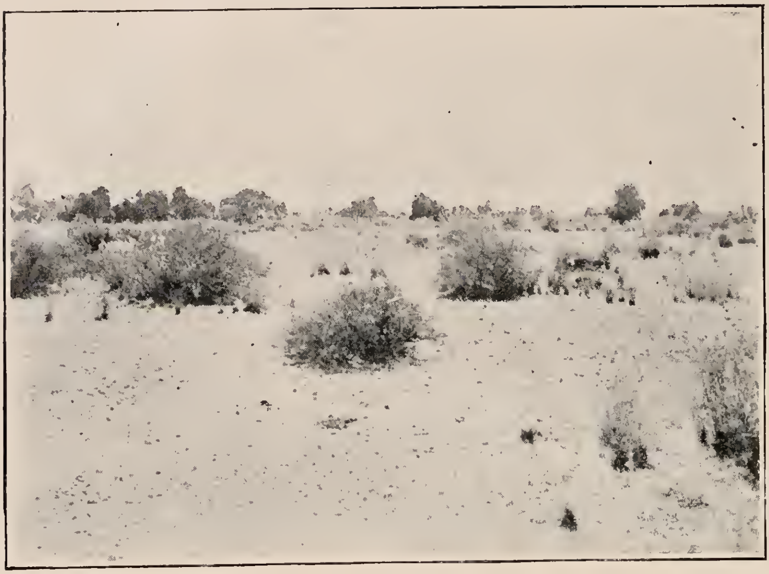
Uses : The white woolly seeds are much used to stuff beds and pillows and its use is said to be protective against rheumatism (Macadam).



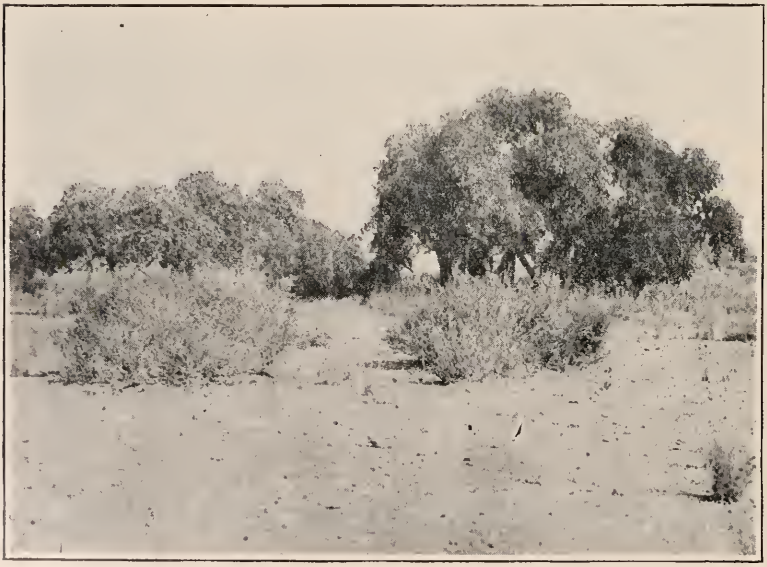
A.—Chhatris near Mandor (Jodhpur State). On the rocky ground: *Euphorbia neriifolia.*



B.—The Bada Bag dam near Jaisalmer. To the right: *Acacia arabica.*



A.—Dry gravelly river-bed, 2 miles East of Sodakoer (Jaisalmer State). Shrubs in the foreground : *Haloxylon salicornicum.* Trees in the background : *Cordia Rothii*, surrounded by a belt of *Calotropis procera.*



B.—Locality as above *Haloxylon salicornicum, Cordia Rothii* and Grasses.

Ærua lanata, Juss. in Ann. Mus. Par. II (1803) 131.

Loc.: W. Rajputana (King). We have not seen this species.

Distrib.: Africa, and warm parts of Asia to the Philippines.

Ærua pseudo-tomentosa, spec. nov.—Suffrutex virgatus, 1½ metrum attingens dense stellatim tomentosus; caulis erectus, racemosus, subteres, obsolete striatus, in parte dimidia inferiore sæpe glabrescens et rubescens. Folia alternata, 80 mm longitudine attingentia, latitudine vero 5½ mm., linearia lanceolata, basi attenuata, apice acuta, subsessilia, generatim dense tomentosa in facie dorsali, in facie vero ventrali sæpe glabrescentia, nervis infra prominentibus.

Flores unisexuales diœci, sessiles in spicis cylindricis, albis vel rubescentibus. Spicæ breves, raro excedentes 25 mm., simplices vel compositæ, numerosæ, generatim sessiles, interdum pedunculatæ, formantes panicula terminalia ampla foliosa. Flores feminei: Bracteolæ plus minusve æquantes sepala, late ovatæ, acutæ, hyalinæ, interdum rubescentes, apice in facie dorsali barbatæ. Sepala 5, 2 mm. longa, duo exteriora lineari-oblonga, tria interiora lanceolata, omnia apiculata, facie dorsali dense villosa, hyalina, nervo medio herbaceo non attingente apicem, interiora vel omnia (sæpe cum villositate) rubescentia; corona staminodialis minutissima sed distincta, 10-partita; 5 dentes coronæ ceteris duplo longiores, omnes apice glandulosi. Pistillum sepalis brevius; stigmata duo, purpurea, glandulosa. Flores masculi: Sunt fœmineis minores. Sepala latiora, duo exteriora ovata, tria interiora elliptico-oblonga, omnia acuta, pallidiora quam in fl. femineis, albida vel flava, vel pallide rubescentia. Stamina 5, filamentis brevissimis vel sepala æquantibus; antheræ oblongæ, 2-loculatæ, loculis dehiscentibus longitudinaliter; staminodia variæ longitudinis; pictillodia breviter stipitata; stylus brevissimus stigmatibus minutissimis.

This species differs from *A. tomentosa* Forsk. in the following points:—The panicles are not naked but leafy; the spikes rarely reach 25 mm., usually less, they are generally much stouter and often compound.

Loc.: Jodhpur: Jodhpur (No. 9086!), Mandor (No. 5954!), Osian (Nos. 5980!, 5952!, 5950!), Bhikamkor (Nos. 5967!), 5976!, 5968!), Phalodi (No. 9088!), near Bhadka (No. 5979!, 9089!), Barmer sand (Nos. 5969!, 5970!, 5971!, 5955!). Jaisalmer: Loharki (No. 9087!), near Loharki (No. 5951!), Sodakoer sandy plain (No. 9085!), Sodakoer river bed (No. 5959!), Jaisalmer (Nos. 5963!, 5962!), Vinjorai (No. 5965!), Vinjorai dunes (No. 5973!).

Fl. in October and November.

Nothosœrua Wight.

Nothosœrua brachiata, Wight Ic. VI (1853!).

Loc.: Jodhpur: Kailana (No. 9050!), Osian (No. 9051!), Jaisalmer: Bada Bag (No. 9052!).

Distrib.: From trop. Africa to India and Ceylon.

Fl. and fr. in October and November.

Achyranthes L.

Achyranthes aspera, L. Sp. Pl. (1753) 204.

Vern. N.: Unda kanta, untaghda, narkata, aghada, andi jhara, kutia bharutia.

Loc.: Jodhpur: Osian (No. 9037!), common in dry places in Jodhpur (Macadam), near Bhadka (No. 9038!). Jaisalmer: Amarsagar (No. 9036!), Bada Bag (No. 9053!).

Distrib. : In the tropics generally.
Fl. and fr. in October and November.
Uses : The water in which the crushed plant has been boiled is taken against pneumonia.

A. aspera L. *var. argentea,* Hook. f. Fl. Brit. Ind. IV, 730.
Loc. : Jodhpur : Jodhpur (No. 9076 !), Kailana (No. 9077 !), Barmer on gravel (No. 9035 !).
Distrib. : Europe, Africa, Arabia.
Fl. and fr. in October and November.

Pupalia Juss.

Pupalia lappacea, Moq. in DC. Prodr. XIII (1849) 331.
Loc. : Jodhpur : Mandor (Nos. 5989 !, 9079 !), Kailana (Nos. 5990 !) 9069 !, Balarwa (No. 5992 !), Barmer (No. 5984 !). Jaisalmer : Bada Bag (No. 5986 !), Amarsagar (Nos. 9078 !, 5987, 5983 !), Vinjorai on rocks (No. 5988 !). Devikot (No. 5985 !).
Distrib. : Tropics of the Old World.
Fl. and fr. in October and November.

P. lappacea var. velutina, Hook. f. Fl. Brit. Ind. IV, 724.
Loc. : W. Rajputana (King).
Distrib. : Deccan Peninsula, Burma.

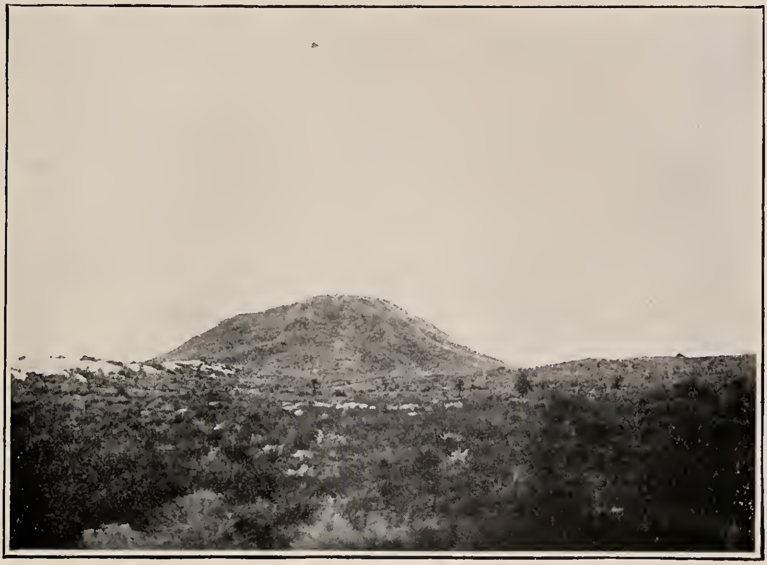
Pupalia orbiculata, Wight Ic. (1852) t. 1783.
Loc. : Jodhpur : Barmer on rocks (No. 9066 !).
Distrib. : India, Ceylon.
Fl. and fr. in November.

Alternanthera Forsk.

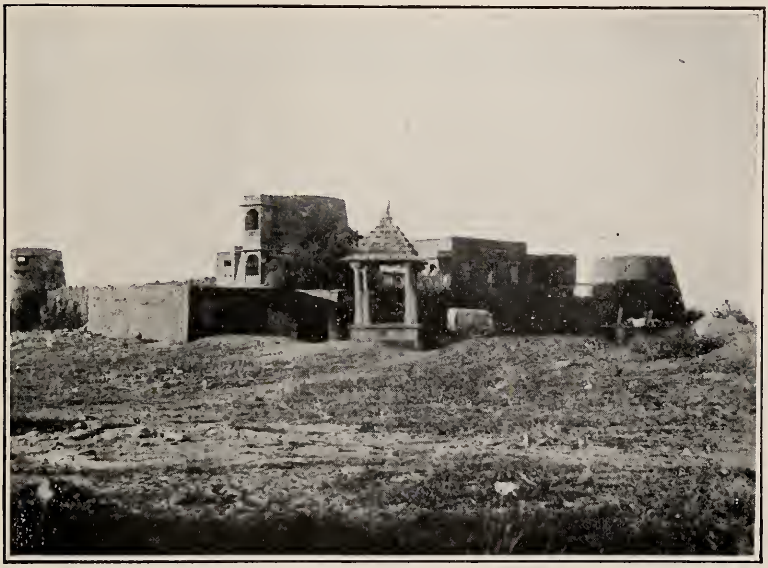
Alternanthera triandra, Lam. Encycl. Meth. I (1783) 95.
Loc. : Jodhpur : Kailana (No. 9067 !). Jaisalmer : Bada Bag (No. 9054 !).
Distrib. : All warm countries.
Fl. and fr. in October and November.

Gomphrena L.

Gomphrena globosa, L. Sp. Pl. (1753) 224.—The Globe Amaranth.
Loc. : Jodhpur : Mandor (No. 9046 !). Introduced.



A.—Hill near Marwar-Lohawat (Jodhpur State). To the left a low sand dune with *Calligonum polygonoides,* in the foreground *Crotalaria burhia, Convolvulus sp.,* and various Grasses.



B.—Typical Fort at Devikot (Jaisalmer State). Scanty ruderal vegetation.

A TENTATIVE LIST OF THE VERTEBRATES OF THE JALPAIGURI DISTRICT, BENGAL.

BY

CHAS. M. INGLIS, M.B.O.U., W. L. TRAVERS, H. V. O'DONEL
AND E. O. SHEBBEARE, I.F.S.

(*With Plates.*)

Although several present and past residents of the district have taken an interest in natural history, we know of no list of the fauna, and have accordingly attempted to draw one up to the best of our ability as far as the vertebrates are concerned. On Inglis' first visit to the district, Shebbeare proposed the drawing up of the list; the latter had already done some collecting and the former had collected in the adjacent districts of Darjeeling and Goalpara. Inglis drew up a tentative list of the birds which during his later visits he was able to add to and confirm many of the species given in it. Later, Inglis and Shebbeare made out the list of mammals and sent both lists to O'Donel, who added several birds and confirmed a number more and sent notes on a number of species; he also added considerably to the list of mammals, more especially bats as, besides collecting himself, he had the Society's collector Baptista working with him for some months. Shebbeare also sent a copy to Travers to add any ducks which had been omitted and for some notes on them which he gave. Travers also drew up the list of snakes, having collected them for some years. He also collected the tortoises for Dr. Annandale who kindly identified them and gave us the names of others probably found in the district; these we have included with a note. None of us have worked out the lizards and frogs, but we have included such as we know for the sake of completeness. The list of fishes for which Shebbeare is responsible is compiled from a previous list made by him. His collection and observations were chiefly made near the hills in the quick-flowing streams, and having had no opportunity of visiting the south of the district where most of the tanks occur, he has been unable to add the numerous Bengal tank and sluggish river fish which are sure to be found. His list is therefore very incomplete. The names of a few mammals and birds were also got from a Settlement Report of the Western Duars by Mr. Sunder written in 1895.

As to the nomenclature, we have followed the *Fauna of British India* except in the mammals where we have tried to give the names from the mammal survey, and in the game-birds, pigeons and doves, where we have followed Mr. Stuart Baker. We have also followed the late Lt.-Col. H. H. Harington in the *Timeliidæ* as far as he had gone before his regrettable death.

The English names of the snakes are mostly taken from Lieut.-Col. Wall's articles in the Journal. The numbers throughout refer to the *Fauna of British India.* All the species in the list have been got or observed in this district by one or other of us unless otherwise stated.

We have taken as our area the whole of the Jalpaiguri civil district which is situated in the extreme N. E. of Bengal adjoining Bhutan, Assam, and Cooch Behar State.

The northern part of the area in which most of our collecting has been done lies in the foothill tract known as the Duars (or Dooars), an area taken over by the British Government after the Bhutan War of 1865 and prior to that time divided by the Bhutan Government for the purpose of rent collecting into a number of small districts known as Bala-Duar, Luckee-Duar, etc., whence the name. The term " Duars " and specially such combinations as Sikkim and Bhutan Duars, Buxa Duars, Eastern and Western Duars, etc., used by writers in describing the habitat of species, lead to a good deal of confusion. Originally, at any rate, the whole of the foothill tract east of the Tista and stretching into Assam was called the Duars (just as the corresponding tract west of the Tista is called the Darjeeling Tarai), but latterly the meaning of the word has been narrowed down by common usage to refer to the " Duars " tea district which only extends eastwards to the Sankos and is therefore co-terminous with the Jalpaiguri District. We presume that Sikkim Duars refers to that part west of the Jaldhaka and Bhutan Duars to that east of this river. Buxa Duar was one of the original divisions made by the Bhutan Government, a comparatively small area, but we believe that the expression " the Buxa Duars " is meant to refer to the whole of the tract between the Torsa and the Sankos. Similarly Eastern and Western Duars though originally used relatively to the Sankos, is some times, we believe wrongly, used relatively to the Torsa. British Bhutan is another rather confusing term which we believe is intended to be synonymous with the Duars.

The north boundary of the district is in some places the foot of the hills and in others the top of the first ridge which at one point (above Buxa) reaches an elevation of nearly 6,000 feet. From the foot of the hills, which is usually well-defined, a stony plateau intersected by the steep-sided beds of streams and rivers slopes gently southwards for a distance of two to six miles to join the true plains, at some places passing into them imperceptibly and at others descending to their level by one or more steep or even precipitous declines. The plains like the plateau slope towards the south, but with a very gentle gradient.

As might be supposed all water courses flow from north to south; those which rise in the Himalayas are torrents in the rains

Tea with shade trees haunts of *Franklinia gracilis* and other Warblers.

Torsa river, the haunt of *Ardea insignis*, *Merganser castor*, etc.; the stones in the foreground affording shelter to the Wall Bat (*Mrotis muricela*).

and have rocky, gravelly, or sandy beds according to their distance from the hills. For the first few miles after leaving their gorges, these hill streams are confined to some extent by the necessity of cutting their way through the plateau, but once in the plains they spread out to an enormous width. Except a few of the larger ones, these hill rivers disappear underground for some part of their length in the dry season causing a waterless tract some miles wide from north to south. The streams which rise in the plains are in almost every respect the opposite of those which rise in the hills; they have narrow beds and high banks with overhanging evergreen vegetation, and vary very little at the different seasons.

The northern part of the district is nearly all either tea-grant or Government forest and the southern part nearly all cultivation; the distribution of these three is shown on the accompanying map. The tea-grants are not all entirely under tea. Parts of them are grazing land, savannah, and, in a few cases, tree-forest. The Government forests are mostly tree-forest though there are still a few fair-sized savannahs and some forest villages.

The forests of the plains consist of a great variety of trees of which the commonest is *Sal* and there is generally a heavy undergrowth of shrubs and creepers mostly evergreen. In the river beds *Khair* and *Sissoo* forest is found. This is not evergreen and usually has a lighter undergrowth or simply grass. The forest of the hills consists of trees with moderate undergrowth and some bamboos in the valleys. Where shifting cultivation has been practised there is an almost impenetrable mass of shrubs and creepers.

The savannahs consist mostly of tall grass usually from 8 to 15 feet high with scattered trees; there are some areas with shorter grass. The area of savannah throughout the district is much smaller than formerly and constantly on the decrease owing to the extension of cultivation, tea and grazing outside the Government forests, and fire protection, which tends to encourage trees, within them.

The cultivation in the plains is almost entirely irrigated paddy land and a good deal of jute is grown. There are practically no large villages as in some other parts of India and the homesteads of the cultivators, surrounded by clumps of bamboos and betel-palms, are scattered among the paddy fields at frequent intervals.

We have included a few photographs of the various types of locality to make the above descriptions clearer to those who do not know the district.

The average temperature in the plains is between 60° and 70° during the cold weather (November to February) and between 75° and 80° during the rest of the year. Frost is rare. The average rainfall at Jalpaiguri is 127 inches. The rainfall increases as the hills are approached and the average in the northern part of the district is about 160 inches while in the hills themselves (at Buxa—2,000 feet) it is 194 inches.

PART I—MAMMALS.

Bengal Monkey (3), *Macaca rhesus.*—Very common.

Himalayan Monkey (4), *Macaca assamensis.*—One in captivity is said to have been caught locally. This may prove to be *Macaca pelops.*

[*Pithecus* sp ?—A pale yellow coloured langur is common in the adjoining district of Goalpara (Assam). Jerdon reported one from the Terai, the adjacent district on the (west) side, which Blanford suggested might be *P. entellus.* Recently we have heard of another observed in the Terai.]

Tiger (29), *Felis tigris.*—Common.

Panther (30), *Felis pardus.*—Very common.

Clouded Leopard (32), *Felis nebulosa.*—One was killed by some coolies at Hanatapara. A clouded leopard and one of the common variety (*Felis pardus*) fought together at Samsing, killing each other. Mr. Phillips got a young cub at Buxa in May, the mother being killed by Bhotias. It is very tame.

Marbled Cat (33), *Felis marmorata.*—Travers got one at Baintguri. Skins are occasionally brought down by Bhotias for sale. O'Donel saw a black cat in the forest near Hasimara which he took to be a melanistic specimen.

[Golden Cat (34), *Felis temmincki.*—May occur here, but we have not found it.]

Fishing Cat (35), *Felis viverrina.*—Common.

Leopard Cat (36), *Felis bengalensis.*—Mr. W. P. Field has shot three leopard cats in the Duars, two on his tea garden, one in Tondu forest; he has also had kittens brought to him twice. Mr. F Murdoch has also shot a leopard cat, which had double upper canine teeth in the upper jaw. Shebbeare sent a skin and skull of a young animal to the Society which he obtained in the district. This cat appears to be not uncommon in the west at any rate. Mr. Field has tried to tame kittens but found them most savage even when quite small.

Jungle Cat (41), *Felis affinis.*—Common. The young when first born show the black on the back continuous, this is replaced in a few days later by broken blackish markings; from these the change to sandy grey and greyish brown is gradual. The young have been taken in in December, February and May. The call of this cat is hard and raucous carrying a long distance and is often heard round bungalows at night.

Large Indian Civet (45), *Viverra zibetha.*—Very common. It appears to be impartial as to its diet, fruit and meat being equally welcome.

Small Indian Civet (48), *Viverricula malaccensis.*—Very common in grass land and also got in the forest where river beds occur. It is doubtful whether this animal is arboreal as stated to be. None of us have seen one climb a tree, and O'Donel has seen one chased by dogs pass a tree without making any attempt to climb.

[Spotted Tiger Civet (49), *Prionodon pardicolor.*—No specimens have been secured by us but O'Donel has had skins from the Bhutias, who got them apparently at low elevations, so it probably occurs round Buxa.]

Indian Palm Civet (51c.), *Paradoxurus crossi* (?).—Some skins seem to be intermediate between this and the next species.

Malayan Palm Civet (52), *Paradoxurus strictus*—Travers got this species in his bamboos at Baradighi.

Small Indian Mungoose (58), *Mungos auropunctatus auropunctatus.*—Uncommon.

Common Mungoose (60), *Mungos mungo mungo.*—Common. "My dog chased a specimen and to my surprise the Mungoose darted up a small tree, *Albizzia stipulata,* and took refuge in the highest branches." (H. V. O'D.)

Crab-eating Mungoose (65), *Mungos urva.*—Decidedly uncommon. It is generally to be found near stream beds whether flowing or dry and usually in pairs, the latter probably being family groups. Their footprints are often seen in the Murti.

Jackal (69), *Canis indica.*

Indian Wild Dog (70), *Cuon dukhunensis.*

Indian Fox (72), *Vulpes bengalensis.*

Indian Marten (77), *Martes flavigula.*—Uncommon. "On one occasion, I found this animal tearing up the partly deserted hive of the jungle bee." (H. V. O'D.)

Brown Ferret-badger (87), *Helictis orientalis.*—Only noted by O'Donel west of the Torsa River.

Burmese Ferret-badger (88), *Helictis personata.*—Recorded by O'Donel in this Journal, Vol. XXV, page 819.

Hog-badger (90), *Arctonyx collaris.*—This is mentioned in Sunder's Settlement Report.

Common Otter (92), *Lutra lutra.*—This is given in Sunder's Settlement Report.

Smooth Indian Otter (93), *Lutra macrodus* —Either or both this and the former are common. Mr. W. P. Field has seen an albino of one of these species.

Clawless Otter (95), *Aonyx leuconyx.*

Himalayan Black Bear (98), *Ursus tibetanus.*—In and near the hills.

Sloth Bear (100), *Melursus ursinus.*—Common.

Sikkim Tree Shrew (102), *Tupaia belangeri chinensis.*—Has been obtained at Hasimara and Bharnabari

Short-tailed Mole (112), *Talpa micrura.*—There is a specimen from Jalpaiguri in the Society's Museum, collected by Shebbeare.

Hodgson's Brown-toothed Shrew (115), *Soriculus caudatus.*—Recorded from Hasimara and Bharnabari.

Himalayan Pigmy Shrew (124), *Pachyura hodgsoni.*—Common at Hasimara.

Musk-rat, *Pachyura* sp.

Common Flying Fox (134), *Pteropus giganteus giganteus.*

Fulvous Fruit-Bat, (137), *Rousettus leschenaulti.*—The Society's collector shot a single example at Hasimara.

Southern Short-nosed Fruit-Bat (138), *Cynopterus sphinx sphinx.*—Several specimens obtained at Hasimara and one at Bharnabari.

Allied Horse-shoe Bat (150), *Rhinolophus affinis himalayanus.*—A single example was taken at Hasimara.

Great Himalayan Leaf-nosed Bat (159), *Hipposideros armiger.*—Only obtained in November.

Bicoloured Leaf-nosed Bat (166), *Hipposideros fulvus.*—One obtained at Hasimara.

Indian Vampire Bat (169), *Lyroderma lyra lyra.*—Recorded from Siliguri, Jalpaiguri and Hasimara and said to be very plentiful at the first two localities.

Eastern Barbastel (172), *Barbastella darjelingensis.*—Hasimara.

Club-footed Bat (180), *Tylonicteris fulvida.*—Mr. Crump got this at Sivoke, just outside the district.

Babu Pipistrel (189c), *Pipistrellus babu.*—A single specimen has been taken at Hasimara.

Coromandel Pipistrel (187), *Pipistrellus coromandra.*—Very common.

Southern Dwarf Pipistrel (187A), *Pipistrellus mimus mimus.*—Very common at Hasimara and has also been recorded from Jalpaiguri and Bharnabari.

Tickell's Bat (191), *Hesperoptenus tickelli.* Hasimara and Bharnabari.

Dormer's Bat (193), *Scotozous dormeri dormeri.*—Bharnabari.

Common Yellow Bat (194), *Scotophilus kuhli.*—Common at Jalpaiguri, Hasimara and Bharnabari.

Wroughton's Bat (193A), *Scotophilus wroughtoni.*—Common at Hasimara ; also recorded from Jalpaiguri.

Harlequin Bat (197), *Scotomanes ornatus.*—Got by Mr. Crump at Sivoke, and O'Donel has obtained it at Buxa.

Hairy-winged Bat (200), *Harpiocrphalus lasyurus.*—A single specimen was obtained at Hasimara.

Wall Bat (212), *Myotis muricola.*—O'Donel got this under stones in the bed of the Torsa river, where it is common.

Painted Bat (213), *Kerivoula picta.*

[Cutch Sheath-tailed Bat (221), *Taphozous kachensis kachensis.*—Obtained by Mr. Crump at Sivoke.]

Particoloured Flying Squirrel (234), *Pteromys alboniger.*—Got by O'Donel from trees felled in his fuel-coupe at Hasimara.

Assam Giant Squirrel (240), *Ratufa gigantea gigantea.*—Very common.

[Long Snouted Bhootan Squirrel (243A), *Dremomys lokriah botia.*—A squirrel (*Sciurus lokriah*) is given by Sunder in his Settlement Report, but as he has not given the following species, *Tomeutes lokroides,* he may have been mistaken but still he calls it an "orange bellied squirrel"; he may have been correct and if so it is probably this species and not *D. l. lokriah.*]

Hoary-bellied Himalayan Squirrel (251), *Tomeutes lokroides.*—Exceedingly common.

Common Five-striped Squirrel (253E), *Funambulus pennanti pennanti.*—Mr. Crump obtained this specics at Haldibari. Sunder says of this squirrel that it is common and as he has spent a good deal of his time in the south of the district he is probably correct.

Hodgson's Tree-mouse (270), *Vandeleuria dumeticola.*—Very common in the tea bushes.

Bhutan Duars Rat, *Rattus rattus bhotia.*—Mr. Hinton has described a new race of the common rat from specimens obtained at Hasimara where it is very common.

Rattus sp.

Nepal House Mouse (282), *Mus dubius.*—Very common.

Himalayan House-mouse (282A), *Mushomourus.*—Apparently not so common.

Southern Field-mouse (287), *Mus booduga.*—Very common.

Bengal Mole-rat (295), *Gonomys bengalensis.*—Very common.

Bengal Bandicoot (297), *Bandicota elliotana.*—Common and often damages tea by cutting through the stem of a bush three or four inches under the soil.

Indian Bush-rat (299), *Golunda ellioti.*—Common at Hasimara.

Bay Bamboo-rat (312), *Rhizomys castaneus.* Very common in tea gardens. "I have heard of this rat being destructive to tea, but have never found it so myself though it is common in the forests round Hasimara." (H. V. O'D.)

Crestless Himalayan Porcupine (316), *Acanthion hodgsoni.*—Common. Their burrows are situated in the banks of ravines, but are very difficult to find owing to the thickness of the jungle.

Hystrix bengalenis (?)—A porcupine other than the crestless one is often turned out of heavy jungle during tiger beats and consequently not shot at.

Common Indian Hare (320), *Lepus ruficaudatus.*—Common among tea and in river beds.

Hispid Hare (325), *Lepus hispidus.*—Not so common as formerly owing to the decrease in grass jungle in the district.

Indian Elephant (332), *Elephas maximas.*—Common. Rogues are prevalent and do a lot of damage. Khedda operations have been carried on during the last few years. Young are born all the year round.

Great one-horned Rhinoceros (334), *Rhinoceros unicornis.*—Probably slightly on the increase, in the few suitable localities, owing to strict preservation. Not nearly so common as formerly.

Smaller One-horned Rhinoceros (335), *Rhinoceros sondaicus.*—Has been shot during the last twenty years. As all rhinoceros are preserved and the tracks and habitat of this and the last are identical and their appearance not very different, unless a close view is obtained, it is difficult to say whether this species still exists here.

Asiatic Two-horned Rhinoceros (336), *Rhinoceros sumatrensis.*—Almost certainly not found in this district, now, though one was shot on the Sankos River (boundary of this district) in 1864. In his Settlement Report Sunder says a rhinoceros was shot in Dalgaon forest but is very rare.

The Gaur (338), *Bibos gaurus.*—A few herds exist, some of which are apparently on the increase owing to preservation. In places they are fairly plentiful. As far as we know they rut all the year round.

The Buffalo (342), *Bubalis bubalis.*—Not common. A few are found in suitable localities.

Capricornis sumatrensis (*jamrachi ?*), (352).—A serow is found in the hills, but we are uncertain to which species it belongs.

Nemorhœdus (*hodgsoni ?*) (354).—A goral, most probably Hodgson's is found in the hills.

The Indian Antelope (357), *Antilope cervicapra.*—Sunder writes in his Settlement Report that this species is found in the waste lands of Falakata, Alipur and Bhalka tahsils ; these lie on the south part of the east side of the district. As far as we know this species is no longer found in the district.

The Bengal Barking-deer (362), *Muntiacus vaginalis.*—Common in forest throughout the district. They rut all the year round.

The Swamp-deer (365), *Rucervus duvauceli.*—Found in heavy savannah, though much less common than formerly. They rut during the latter part of the rains.

The Sambhur (367), *Rusa unicolor.*—Next to the barking-deer this is the most plentiful deer. They rut during the cold weather.

Spotted Deer (368), *Axis axis.*—A few small herds, very local. We believe they rut during the cold weather.

Hog-deer (369), *Axis porcinus.*—Plentiful in suitable localities. We believe they rut during the rains.

A deer intermediate in size between the Sambhur and Hog-deer and resembling the latter has been shot in the same locality on several occasions. We have seen heads and believe a specimen was forwarded to the Society by Mr. W. P. Field who was the first to draw attention to the matter.

Indian Wild Boar (374), *Sus cristatus.*—Extremely common.

Pigmy Hog (376), *Sus salvanius.*—Rare now, though probably commoner before the reduction of savannah land. Travers has seen them and Shebbeare, who knew the animal in Goalpara where they are common, believes he has seen them. In both cases they were seen in Sal forest.

Gangetic Dolphin (379), *Platanista gengetica.*—Found in rivers in the south of the district.

Indian Pangolin (399), *Manis crassicaudata.* } A pangolin has been reported
Chinese Pangolin (400), *Manis aurita.* } but we have never seen it.

THE BIRDS OF PREY OF THE PUNJAB

BY

C. H. DONALD, F.Z.S.

PART III.

(*Continued from page 655 of Vol. XXVI.*)

Type F.

(*With Plate I.*)

This chapter deals with 5 genera of the Birds of Prey, comprising 9 species, of which one has really no business here, being unknown to the Punjab so far, but as it has been recorded from Quetta, and may wander into the districts adjoining Baluchistan, I give it a passing mention. This is *Milvus migrans*, the Black Kite.

All the species of this type have one characteristic in common, and that is, *a tarsus feathered for half its length or more, in front, and naked behind.* All except one are birds of medium size, *i.e.*, about the size of the ordinary Pariah Kite. The one exception is the little Black-winged Kite (*Elanus cœruleus*) which is not much bigger than a pigeon, except that it has long pointed wings which make it look bigger, when seen flying.

With regard to the genus *Buteo*, the Buzzards, Mr. Hume has pointed out that the feathering of the tarsus is variable, but for the purpose of these papers, I think, it will be found that the feathering is a good enough guide, and though the extent of the feathering may vary in different species of the genus, or even in individual specimens of the same species, it will generally be found to conform to the keys herein given.

The genus *Buteo* has been a bone of contention among ornithologists for a very long time, and whether the various species have, even now, been definitely sorted out correctly, is by no means certain.

A genus in which there is no definite limit to the immature plumage, and in fact, in which there is no distinctive plumage for any age, among its many species, must obviously be a subject for controversy and be difficult to divide up into species, unless there are other constant factors capable of conferring specific rank.

Whether *Buteo vulgaris*, *B. plumipes* and *B. desertorum* are really separate species or whether they are merely phases or races of the same species, need not be here discussed. We are, here, only concerned with the simplification of the present acknowledged species, and not with arguments for or against their retention or change.

BIRDS OF PREY OF THE PUNJAB.

Fig. 1—Represents a Buzzard flying directly overhead.

Characteristics.

Wings ample, rounded and regular, *i.e.*, almost in a straight line from the body to the tip of first primary. Usually held slightly upwards and above the level of the back, though this is by no means so constant a feature of the Buzzards as that of other species already dealt with. The tertiaries curve into the body forming a slight triangle with the base of the tail. There is always a light patch on the wing, at the base of the primaries, which is visible both above and below and is a characteristic of all species of Buzzards and of every phase of plumage, to a greater or lesser degree.

The tail is medium, neither long nor short and frequently spread out, when the bird is soaring.

Colouring is no criterion and may vary from a deep chocolate brown throughout, to very light buff on head and body, and light brown wings. In the former phase, however, the wing patch is white and very distinct, as also white barring on the tail. In the latter, the wing patch may not be very distinct but is always visible, and the tail, especially above, is almost sure to be some shade of *reddish* brown.

Fig. 2—Represents a Kite flying directly overhead.

Characteristics.

Wings long and more often curved than straight. If curved, as in the illustration, the ends are pointed, but if held straight they will be rounded, but not so much as in the Buzzards, and during the later summer months, individuals will be seen with very pointed wings. This is due to irregular moulting and the uneven growth of the primary feathers. The characteristic flight of the Kite, as seen round stations, is usually with curved wings as shown in the illustration, as though preparing to stoop. The white wing patch is generally the sign manual of *Milvus melanotis*, but *govinda* is occasionally similarly adorned, to a somewhat lesser extent.

The tip of the primaries, especially when the wings are curved, are usually *below* the plane of the body.

Tail long and *forked*. This characteristic of all Kites makes them unmistakable for anything else, and is noticeable both when the bird is sitting or flying.

Fig. 3—Represents a Black-winged Kite flying directly overhead.

Characteristics.

Wings long and pointed. The front portion, together with head, body and tail white, the margins of the open wing, throughout, black. The upper portion of the body is black and dark grey.

The slight washing of brown on the breast of young specimens is not visible, except at very close quarters, so the whole of the under-surface of the body appears to be pure white.

Tail medium, usually compressed and appears very narrow.

This bird is also unmistakable for anything else on account of its size and curious colour, the latter resembles some of the male Harriers and *Neophron*. Does not very often soar. Hovers a great deal with slow deliberate beats of the wings.

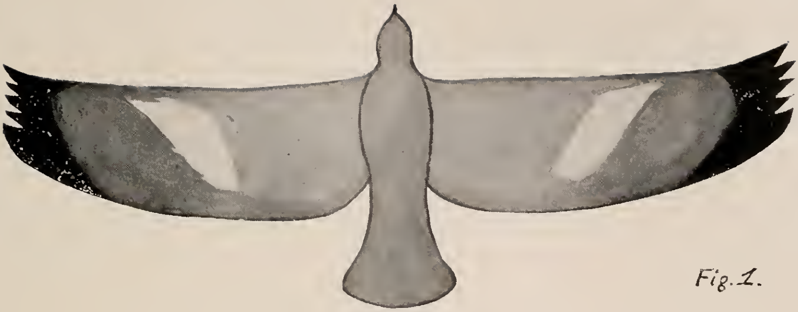


Fig. 1.

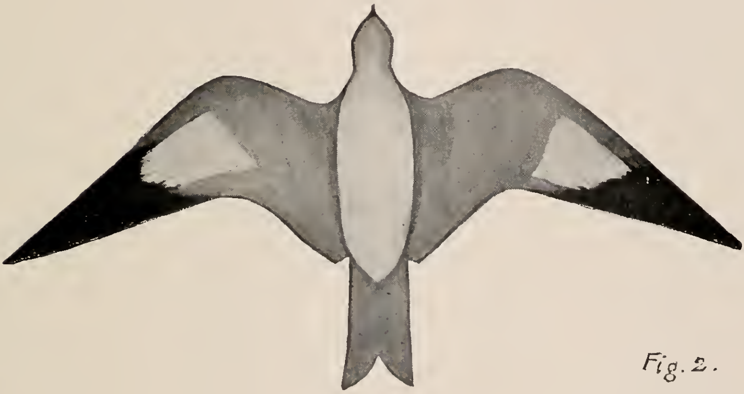


Fig. 2.

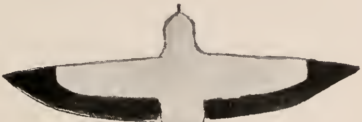


Fig. 3.

The 5 genera and the 9 species of this type (F) are as under: —

Genus.	*Species.*	
Milvus.	*M. govinda.*	The Common Pariah Kite.
”	*M. melanotis*	The Large Indian Kite.
”	*M. migrans.*	The Black Kite.
Haliastur.	*H. indus.*	The Brahminy Kite.
Buteo.	*B. ferox*	The Long-Legged Buzzard.
”	*B. leucocephalus.*	The Upland Buzzard.
”	*B. desertorum.*	The Common Buzzard.
Pernis.	*P. cristatus.*	The Honey Buzzard.
Elanus.	*E. cæruleus.*	The Black-Winged Kite.

Genus.	KEY TO GENERA AND SPECIES.
Milvus.	Size medium; *tail forked*; *tarsus* 2″ *to* 2¼″; plumage in adult dark brown above, lighter (usually) below.
Haliastur.	Size medium; *tail rounded; tarsus about* 2″; plumage in adult reddish or chest-nut brown above, white below.
Buteo.	Size medium; *tail rounded*; *tarsus* 2½″ *to* 3¾″.
Pernis.	Size medium; bill weak and elongate; lores and sides of head covered with *small scale like feathers,* like forehead and chin, unlike all other birds of prey.
Elanus.	Size small; tarsus *under* 1½″; colour very pale to pure white below except primaries which are black, greyish-brown to black above.

Species.	
M. govinda.	Length about 24″; wing in male 16·75 to 18·5 and in female 17 to 19·5; head tawny or rufous with black streaks in adults.
M. melanotis.	Length over 25″; wing in male 19 to 20·5 and in female 19·25 to 21·5; a light patch visible on the under part of the wing, when flying.
M. migrans.	Length about 23″; wing about 17″ or under; head whitish with black streaks in adults.
B. ferox.	Tarsus *about* 3·75, feathered for about half its length, naked part, *in front, scutellate*; wing *over* 16″.
B. leucocephalus.	Tarsus about 3·5, feathered for about two-thirds its length, naked part, *in front reticulated; wing over* 16″.
B. desertorum.	Tarsus *under* 3″. Wing *under* 16″.
H. indus.	As for genus.
P. cristatus.	As for genus.
E. cæruleus.	As for genus.

TYPE F.

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus *Milvus.*

No. 1229. ***Milvus govinda.*** The Common Pariah Kite.

Characteristics. Size medium; tail forked; head tawny or rufous with black streaks in adults; wing in males 16.75″ to 18·5″ and in females 17″ to 19·5.″ (Blanford).

Colouration. Dark brown throughout usually. "Head tawny or rufous with blackish shaft-stripes; a patch behind the eye including the ear-coverts, uniform dark brown; first five primaries and large primary-coverts blackish, later primaries and secondaries coloured like back; all the quills more or less mottled with whitish on the inner webs towards the base, and banded with blackish brown cross-bars, tail brown above, whity brown below, with numerous darker cross-bands, faint and obsolete in some (probably old) birds; lower parts rather paler than upper, whitish at the chin, and generally, but not always, becoming tinged with rufous on the abdomen and lower tail coverts, and always dark-shafted throughout, with pale or rufous stripes on each side of the dark shaft-lines. Lower wing-coverts, like breast, except the larger coverts, which are ashy brown with pale bands.

Young birds have broad buff or white shaft-stripe to the feathers of the head (except the ear-coverts), neck and lower surface, and buff or whitish tips to the feathers of the back, wing-coverts, scapulars, secondaries and tail-feathers." (Blanford.)

Bill black, cere and gape yellow in old birds, greenish grey in the young; irides brown; legs and feet yellow, pale greenish grey in young birds; claws black. (Blanford.)

Measurements. Length of females about 24; tail 12; wing 18·5; tarsus 2·1; mid-toe without claw 1·6; bill from gape 1·7. Males are smaller—length about 22·5, wing 17·5. (Blanford.)

Habits, etc. This is without exception the commonest bird of prey in India, except in the higher ranges of the Himalayas. Found in every town and village from the plains to the Hill Stations of Simla, Dalhousie and in fact wherever one might expect to find a slaughter-house. It lives for the most part on offal and practically nothing comes amiss to the Pariah Kite, from a native sweet-meat to a dry bone.

It is by no means uncommon to see a kite swoop down and take a clawful from the contents of a sweet-hawkers basket on a railway station, and on one occasion the writer saw an entire basketful turned over and the contents shot off the platform on to the lines, under a carriage. In this case the claw of the kite must have caught, for a second either in the basket work or a bit of string.

It did not prevent the hawker from retrieving his lost property and disposing of it to the passengers, before the train left, with the added advantage of a little extra weight! Quite lately the writer and a friend were having breakfast under a tree. The friend had just transferred a liberal helping of Irish stew to his plate, which was in his lap and was on the point of bringing his knife and fork to bear on the delicacies, when a kite swooped noiselessly from above and sent well over half the contents of the plate flying to the ground, much to the delight of a miserable "pi" dog which cowered alongside. Yet with all their daring, I know no bird more difficult to catch than a kite. It is useless to put up a net for the most hungry of kites, even with the most tempting of baits behind it.

The kite will circle round once or twice and "move on." The ordinary nooses which seldom fail to catch a falcon will only catch a kite if set in longish grass where they are absolutely invisible, and then only if several of them happen to be about.

The best way of catching one is to drop three or four pieces of meat about a lawn and over the most inconspicuous and uninviting piece, place a couple of horse-hair nooses, mixed up with bits of straw and attached to a long bit of concealed string.

The flight of the Kite is unmistakable. The forked tail is enough in itself to proclaim any member of *Milvus* from afar, but even if this useful appendage happens to be wanting, there is no mistaking the bird. The wings are very frequently bent from the first joint, and the primaries, as often as not, are seen to be on a lower level than the body. The flight itself is very light and the circles are irregular and erratic.

They build usually on trees, but not infrequently on buildings, making a nest of twigs, lined with grass and rags and lay 2 to 4 eggs, pale greenish white, blotched, or spotted with brown or reddish brown and measure according to Blanford, 2·19″ by 1·77″.

I have given the description of this species from the "Fauna of British India" in full, as the above will answer equally well for the next two species, with but little differences. This and the next species are by no means easy to recognise one from the other and though the types of each present no very great difficulty, one frequently comes across specimens, which are probably hybrids, and might pass for either. A kite which answered to the description of *melanotis* in the air, has conformed to the measurements of *govinda*, in the hand. The breast markings of the kites vary considerably and occasionally a very light coloured bird, with dark shaft-stripes, almost resembles the breast of a "*Spizaeti*, except that the dark shaft-stripes of the kite are broader.

In the air, this species can usually be recognised from the next species, by not having the moon-shaped pattern of whitish or buff, on the wing underneath, which is a conspicuous feature of *melanotis*, but even this distinguishing mark is by no means a sure guide, and may be found indistinct where it should stand out, and certainly present where not expected.

Even in *migrans* I have found specimens which appeared to be links between *govinda* and *migrans*, conforming to the latter in everything except the very important head markings, the ground colour being more inclined to rufous than white. Out of over a dozen examined in Basra in one day, I found great variations, in the head markings as well as in measuments, but as *migrans* is so far, unknown to the Punjab, though having been found in Quetta, it should not be included in these papers.

No. 1230. ***Milvus melanotis.*** The Large Indian Kite.

Characteristics. Size medium ; tail forked ; wing in males 19″ to 20·5″ and in females up to 21·5″ ; length over 25″.

Colouration. Very similar to the preceding species but it may be generally recognised from the latter "by the amount of white on the inner webs of the quills near the base, forming a conspicuous white patch below the wing, as in Buzzards. As a rule, too, the lower abdomen and under tail-coverts are much paler in *M. melanotis* than in *M. govinda*. Some birds, however, appear almost a passage between the two" (Blanford.)

Bill bluish ; cere yellowish white ; irides hazel brown ; legs dull china-white ; claws black. (Oates.

Measurements. Length of male about 25″ ; tail 13″ ; wing 19′ to 20·5″ ; tarsus 2·2″ ; mid-toe without claw 1·6″; bill from gape 1·75″. Females are larger, length 27″ ; wing 19·25″ to 21 5″ ; tail 13·5″.

Habits, etc. Very similar to *govinda* except that it is supposed to be a somewhat shyer bird than the latter and is said to have a heavier flight, but personally I cannot see any great difference one way or the other, as regards its flight.

As I have already said, it is not always easy to differentiate between this and the preceding species, but on the wing, this species looks a good deal bigger than the difference in measurements of the two species would appear to justify, and a female *melanotis* can pretty well always be recognised, even if the male may leave room for doubt. Size, in conjunction with the lighter colouring and the wing patch, will generally suffice to set *melanotis* apart, especially if they are seen together, as they frequently are, but as already stated, these are by no means infallible guides.

This species is said to build in the Himalayas from January to May ; the nest and eggs are similar to those of M. govinda, but are said to be slightly larger, averaging about 2·31″ by 1·8″. I cannot speak with any authority, not having found the nest, but I certainly have seen the bird in the plains of the Punjab during the summer.

Lt.-Col. Rattray records having found nests of this species in Thal and Murree respectively (Vol. XII, p. 344 and Vol. XVI, p. 662 of the B. N. H. Soc. Journal.)

No. 1231. *Milvus migrans.* The Black Kite.

Very similar to *govinda* but distinguished from that species by having " the edges of the feathers on the crown and nape whitish instead of light brown or rufous, and by the more distinctly ferruginous colour of the abdomen." It is also smaller, a female measuring about 23″ in length and a male smaller still.

Lt.-Col. T. E. Marshall records finding the nest of this species round Quetta (Vol. XV, p. 352 of the Journal of the B. N. H. Soc.)

There is no record of this species having been found in the Punjab.

Genus *Haliastur.*

No. 1228. *Haliastur indus.* The Brahminy Kite.

Characteristics. Size medium ; tail rounded ; tarsus about 2″ ; wings long and exceeding the tail. Colour in adults chestnut brown above and white below.

Colouration. Very distinctive in the adult. The whole head neck, sides of the head, and practically the whole of the underparts, down to the middle of the abdomen white, with dark shaft-stripes. Practically the whole of the upper surface, except head and neck, chestnut or deep chestnut brown. Tail chestnut,except the end which is whitish. Primaries blackish.

The young bird is very kite-like except that the whole plumage is somewhat lighter than that of the average kite, and with more rufous-brown on the lower parts. A later phase shows some white on the upper surface and the rufous is a little more pronounced, and the general colouring somewhat lighter than in the first stage.

" Bill bluish horn ; cere yellowish ; iris brown ; legs and feet greenish-yellow."

Measurements. " Length of female about 19″ ; tail 8·5″ ; wing 15″ ; tarsus 2″ ; mid-toe without claw 1·4″. Males a very little less." (Blanford.) Expanse about 4′-9″ to 5′.

Habits, etc. A very familiar feature of most tanks, canals, jheels and in fact wherever there is a little water, though it is frequently found in other localities as well.

Most commonly met with, in the Punjab, just before and during the monsoons, when, presumably, there are a greater number to be seen in the distinctive dress of the adult. It soars well but does not usually attain to any great height. and is more given to sitting on trees, or the ground, overlooking a pool of water. It lives chiefly on frogs, lizards, rats, insects and is a past master at taking grasshoppers off the stems of growing rice. This species may often be seen sailing over rice fields and swooping suddenly and apparently just touching the stalk of a plant in its flight and going on without the smallest check. If watched, it will be seen to bend its head down to its claws and take the insect into its mouth or if winged, the wings of the insect will be seen to drop first and then the head may be bent down two or three times, depending on the size of the grasshopper, until it is all eaten. The unerring aim with which it invariably takes off the insect without seemingly so much as touching the stalk is wonderful. I have never seen it carry off any of the plant, and nor have I ever noticed a check, which would be the case if the stem was caught in its talons, together with the insect.

Though considerably smaller than a kite, this species holds its own with ease and frequently makes a kite give up a tit-bit. It is readily caught and the bait, behind a net, might be anything from a mole-cricket or a frog to a chicken, but the net must be well concealed or have a good back ground of brushwood or trees, as the Brahminy Kite does not come down with the dash of a hawk or a falcon, so has plenty of time to see its danger and swerve.

Unlike the kites, which will almost invariably sail round once or twice before making a swoop, and are therefore almost impossible to catch in a net, the Brahminy Kite will come absolutely straight from its perch and make for the net without hesitation.

It is a most disappointing bird in the hand and is much better admired at a distance, where its lovely white and chestnut plumage is a distinct acquisition to the landscape.

In the hand it will be found very coarse and bedraggled, and not at all the lovely bird we see in the air.

The flight is kite-like but the wing is not so often bent as in that of a kite. The young, at a glance, might be mistaken for a kite, but one glance at the tail, which is *not* forked in the Brahminy Kite, will dispel all doubts. The wing too is broader and apparently more rounded in flight than in that of a kite.

This species is distributed throughout India and is to be met with quite high up in the Himalayas at times. I saw a pair at Kajiar, between Dalhousie and Chamba, with two fully fledged youngsters in attendance, and have also found them on Himalayan streams at 8 to 9,000 ft. elevation.

The cry is a shrill squeal not unlike a Kite's.

They breed in the spring, building a nest of sticks, lined with leaves, on a tree, and lay usually two eggs, "greyish-white, unspotted or scantily speckled or blotched with reddish brown, and measure about 2·02 by 1·65." (Blandford).

Genus *Buteo.*

No. 1239. *Buteo ferox.*. The Long-legged Buzzard.

Characteristics. Size medium; tarsus about $3\frac{3}{4}''$, feathered for about half its length. Naked part, in front, scutellate; wing over 16″.

Colouration. Very variable and practically impossible to describe accurately for each phase, without taking up a great deal of space. To begin with there are two very distinct phases of plumage of this species, *viz.*, the light or pale variety and the melanistic form. If the differences ended here it would not much matter and each could be described separately, but in each of these forms there are widely different characteristics, which make any sort of description of a species as a whole, absolutely misleading for any individual.

I quote below from Hume's Rough Notes, p. 279, to show what might be expected regarding the variations in even one of the selected phases.

"At one end of the series, the whole of the chin, throat, breast, abdomen, vent and lower tail coverts, in fact the whole lower parts, are white, with only the faintest possible fulvous tinge in some places, and a few only of the feathers with dark shafts. A few of the feathers of the sides have irregular, patchy, rufous brown bars. The axillaries are pure white, with a faint rufous spot towards the tip; the tibial plumes are pale rufous, mottled with rufous white; and the tarsal plumes are white broadly barred with pale rufous.

At the other end of the series, the chin, throat, breast and lower tail coverts are a rich rufous buff, all the feathers, except those of the lower tail coverts, with conspicuous dark shafts, and rich brown or rufous brown, linear, lanceolate, shaft stripes. The whole of the sides, abdomen vent, tibial and tarsal plumes, a very rich rufous brown edged with brighter rufous, and the axillaries pure cinnamon colour. Between these two extremes, there is every intermediate type of colouring of the lower parts."

Under the circumstances, individual descriptions of such variations would take pages of print, whereas a general description, or the description of one particular phase would only occasionally apply and thus be confusing, especially when it is remembered that in the above quoted extract from "Rough Notes" Mr. Hume is only dealing with the pale phase.

It might be said, that when dealing with this species, or even genus, one might safely expect to find anything from a chocolate brown bird, to one that is almost white beneath to pale brown above.

In these papers I will not attempt to give any description of this species, so far as the plumage is concerned.

"Bill brownish plumbeous, tip black; cere yellowish-green: irides brownish-yellow; legs dingy pale lemon-yellow." (Hume.)

Measurements. Length of female 24″: tail 10·5″; wing 18″ to 19¼″ tarsus 3·75″. Male, length 22″; wing 16·25″ to 17·9″. (Blanford.)

Habits, etc.

The Buzzards resemble the eagles to some extent. They are sluggish birds, and though they do at times soar to great heights, and soar well, they are much more at home sitting on the stump of a tree, or even on the ground, on the look out for rats, frogs, lizards and even insects, on which they prey.

Whatever be the colouring of this species, it can, as a rule, be easily identified both in the hand and in the air. A tarsus feathered for half its length or more, in front, and naked behind, at once places it in Type F.

Once this is done the rest is simple, by elimination of the remaining genera, as follows :—

Kites, 3 species, all have forked tails ; tarsus $2\frac{1}{4}''$.

Brahminy Kite, tarsus only 2″, wings exceeding tail, colouration white and chestnut.

Black-winged Kite, size very small ; tarsus under 2″.

The Honey Buzzard, bill weak and elongate ; sides of head covered with small scale-like feathers ; tarsus about 2″.

The above eliminates 6 species and leaves the 3 Buzzards, in all of which the tail is rounded, differentiating them from the Kites and the tarsi in all three are over $2\frac{1}{2}''$, which fact sets them apart from the other three species, as well as, of course, from the Kites.

In the air, a Buzzard, as such, is unmistakable from the light moon-shaped patch, due to the light bases of the primaries, on each wing, visible in every phase of plumage.

These birds begin to arrive in the plains in October and are then common throughout the Punjab. Not often found in groves or jungles, but every plain, dry ricefield and desert can supply its quota of B. ferox. In the lower hills, shortly after the rice has been harvested, these birds will be found on the trees adjoining the fields and as frequently, sitting on the "bunds" between the fields. If not disturbed, a Buzzard will return time after time to the same tree, after flying down for an insect or a rat.

Occasionally they are very sociable and three or four may be seen sitting at opposite ends of the same field, seldom on the same tree, but usually I have noticed that the first comer establishes his right to the locality and drives away all intruders.

This species has a curious habit of descending on to the ground towards dusk and looking for his food thence. This is comprehensible in birds which take their quarry on the wing, for they can then see it better against the sky-line, but since the Buzzard takes nothing on the wing, except *termites*, it is strange he should adopt this plan. I do not mean to say that all Buzzards come to the ground in the evening, but simply that the sight is by no means uncommon, and I have seen them leave a tree to sit on the ground, at dusk.

The Long-legged Buzzard is said to breed in the Himalayas, but comparatively few must stay in this country to do so, as it is almost invariably *B. desertorum* which is found in the Himalayas, and after April the Long-Legged Buzzard is rarely seen. "The eggs, 2 to 4 in number, are broad regular ovals, greenish-white richly blotched with reddish-brown, and measure about 2·3 by 1·8." (Blanford.)

The only record of recent years, in the B. N. H. Society's Journal, regarding this species is in Vol. XV, p. 352, by Capt. Marshall, R.E., who says, "I think, perhaps some breed in the hills—(he refers to Quetta)—as I have observed them at the end of April and have had eggs brought me by a native, on one occasion, which I think must have belonged to this bird."

(To be continued.)

MISCELLANEOUS NOTES.

No. I.—NOTE ON THE MALABAR SLENDER LORIS, *LORIS LYDEKKERIANUS.*

Through the kindness of Lt.-Col. F. Wall, I.M.S., the Society received on 13th June last a living example of a female Mysore Loris, *Loris lydekkerianus* and her two young. Shortly after their arrival the mother and her two babies were put in a large wire netting cage, which, half way up, had some branches fixed across and on one side near the top a box with one side removed. All day long the mother used to sit curled up on the top of box, but apparently at night wandered about the cage. On the bottom of cage were two Jerboas, *Gerbillus* sp., which had been brought down from Mesopotamia by Major Cheesman in the spring of 1917, and were thriving splendidly. Most of the day they spend their time in a box, which they entered by a hole at one end, coming out in the evening to feed and frisk about. Two days after the Loris was put into the cage the hamal came to me in the morning with a dead Jerboa, which had been decapitated and its head eaten. Thinking it was the work of a rat we carefully examined the cage but found no hole, by which a rat could have entered. On the following morning the remaining gerbill was found killed and eaten in the same way and there was no doubt that the Loris was the culprit.

It seems rather surprising that such an active and vigorous animal as a Jerboa could have been caught and killed by a Slender Loris, more especially when she was handicapped with two young on her breasts.

During the day the Loris used to sit on a branch or on the top of the box rolled into a ball with her head tucked in against her stomach, her hands and arms also hidden away inside and only her legs and feet visible, the latter clasping the branch or supporting her on the ground. In the middle of this ball and firmly fastened on to each of the mammæ were the two young and it was a mystery how they were not suffocated. Occasionally a small foot or hind leg was visible or a grotesque little animal with huge head, and body tapering away to almost nothing, would immerge from the ball and mount its mother's back, slowly grasping the fur with its hands and feet, chiefly the latter. As Col. Wall has rightly suggested the young Lorises forcibly reminded one of a bat in their movements, especially when crawling over their mother's back. Unfortunately the two young ones did not live long. One of them dropped off its mother one morning, and after a few attempts to pick it up from a branch too high above, the mother gave up and retired with the remaining one to another corner of the cage. The young one was picked up, warmed and fed and put on to its mother only to fall off. Again it was put on and this time it seemed to be all right and was seen firmly attached to its mother's breast when the Museum was closed for the night. In the morning however the hamal found both dead at the bottom of the cage, one appeared to have died, while the other had been killed by the mother.

Colour.—In colour the young are much lighter than the adults The hair on the back is dark for the basal half like the adults, but the remainder is of a very pale whitish-grey. Down the middle of the back there is a pale fawn colour line, which starts at the posterior end of the white head-streak and ends at the anus. The markings on the face and round the eyes are much browner than in the adult and the hairs in the inside of the ears are the same colour as the face markings.

Age and time of Breeding.—Col. Wall suggests that these two young ones were born in the beginning of June or end of May and probably he is about right. The skull shows that all the milk teeth are visible.

Mr. Shortridge has recorded in the Coorg Mammal Survey Report that the late Mr. Graham found on March 16th a female, with an apparently recently born young one of the allied species *Loris malabaricus,* and of the present species he obtained young specimens in October, but unfortunately no mention is made in the Report as to their approximate age.

N. B. KINNEAR.

Bombay Natural History Society,
25th July 1919.

No. II.—TIGER, *FELIS TIGRIS,* CLIMBING TREE.

The following unusual though not unprecedented occurrence might interest Shikari members. A wounded tiger (I suspect tigress, they are generally more active) took a boy out of a tree from over 20 feet from the ground. It managed to grab him by the ankle and the combined weight of the tiger and boy broke the branch on which the boy was sitting and brought him to the ground. The ankle was broken, a compound fracture and the leg had to be amputated, but the boy, a Bhil, is doing all right. The lowest claw mark on the tree is 3 feet from the ground, and the highest 21 feet. This means that the tiger not only jumped, but also actually climbed—though the climbing was only a couple of jerks upward a few feet at most, just enough to reach the boy's ankle.

This happened a few days after the beginning of the month. There was only one gun—my assistant who did everything possible to get the tiger but it got away. The rifle was a ·450 *express* (not H. V.) with Eley's hollow bullets—an inadequate weapon for tigers and such like animals as previous experience has shown. The tiger had gone through the stops and thought itself clear. The boy (he is about 16 or 17 I think) was sitting outside the line of stops—his own idea—and nobody knew he was there. He thought he would be clever and stooped down to 'shoo' the tiger back which was too much for the latter's nerves. I give the account as it was given to me by letter, and afterwards by word of mouth.

Instances of the kind are sufficiently uncommon to make each one that occur perhaps worth recording. Many years ago a stop was taken out of a tree by a wounded tigress in Kanara. I think General Peyton mentions it in the Gazetteer and I know myself of one case in which a tigress got into a tree—also in Kanara to get out of the way of dogs. But this was a tree with big branches low down—a *Ficus,* as far as I remember, and the heaviest tiger could have jumped into it easily enough and in fact have slept in it if he wanted to.

G. MONTEATH, B.A., I.C.S.

Jalgaon, East Khandesh,
24th April 1919.

No. III.—WILD DOGS, *CUON DUKHUNENSIS,* AND SAMBHUR.

Seeing an account of the behaviour of wild dogs with a cheetal fawn in the last number of the Journal reminds me of a most interesting sight I saw in the Nilgiri Hills in 1914. I and a friend were fishing the Billithada Halla river in the Kundahs, at an elevation of about 7,500′, on a misty morning, when suddenly the mist lifted and we found ourselves close to a herd of sambhur, consisting of one stag, about 10 hinds and one calf.

They, presumably being as surprised to see us as we them, did not move off more than 200 yards, and while we stood looking at each other I noticed two wild dogs approaching the herd.

They made straight for the calf which left the herd and galloped full tilt for the river, and as he approached it we noticed 9 or 10 more dogs, coming up parallel with the river and trying to cut him off.

The calf reached the bank first only a few yards from where we were standing, hit his fore feet on a rock as he leapt into the air and turned a complete somersault, but landed safely in the middle of the river and was soon making off on the other side.

None of the dogs attempted to follow him, but this may have been due to the double shock they received from watching the acrobatic performance of their quarry and seeing two human beings at such close quarters.

Instead they wandered back towards the herd of sambhur with which they mingled in a most friendly manner.

Occasionally one, or perhaps two dogs, would approach a hind but she merely put her head down as a cow does to domestic dogs, and then they would cease to worry her. Eventually the sambhur drew off in one direction and the dogs in another.

I have told this incident to many old residents, who imagined they knew all about the habits of the wild dog, but they have always been at a loss to understand why they did not attack at least one of the hinds more determinedly.

Some people have suggested that they were not hungry but they ran the calf as far as the river strongly enough.

Personally I am beginning to think that wild dogs seldom attack anything so large as a full-grown sambhur, for on the several occasions on which I have come across the remains of this animal killed by wild dog it has always been not larger than a half-grown calf.

F. WARE.

CIVIL VETERINARY DEPARTMENT,
MADRAS, *25th July* 1919.

No. IV.—DISTRIBUTION OF THE DIFFERENT RACES AND SPECIES OF TAKIN (*BUDORCAS*).

Having been a member of the Bedford expedition which discovered and shot the first Shensi takin (*Budorcas bedfordi*) in 1910; and having met with a herd of takin (presumably *B. taxicolor*) on the mountains directly east of the 'Nmai-hka in 1914, I was very much interested in Mr. Mill's letter in the last number of the journal.

Without accepting Mr. Mill's proof as final, he certainly makes out a strong case for the existence of takin between the Chindwin and Assam; and assuming for the moment its existence, we have two points to consider.

(*i*) Is it *B. taxicolor, B. bedfordi* or *B. tibetanus?*
(*ii*) Whence did it arrive in the Saramatti region?

Now let us consider the localities where takin are known to be found. They are, from west to east:—

(*i*) The Bhutan Himalaya.
(*ii*) Zayul and the Mishmi Hills.
(*iii*) The Salween-Irrawaddy divide.
(*iv*) The mountains of N. W. Ssu-chuan, W. China.
(*v*) The Tsin-ling range in Shensi, W. China.

The first three localities are occupied, so far as is known, by *B. taxicolor,* the fourth by *B. tibetanus,* the fifth by *B. bedfordi.*

The remarkable point about the *known* distribution of the takin is its apparent discontinuity. Thus area (i) is separated from area (ii) by the whole breadth of the Upper Assam valley; area (ii) from area (iii) by the deep valley of the Taron (or eastern branch of the Irrawady); area (iii) from (iv) by at least the Salween and Yangtze valleys. The separation of areas (iv) and (v), though very considerable in miles, is more difficult to define; the plain of the upper Han river, and several big tributaries of the Yangtze, however, intervene. And there is this significant feature about it, that the new species, *B. bedfordi* occurs on a range running at right angles to all the ranges on which *B. taxicolor* (with *B. tibetanus*) is found.

This statement requires explanation. The most western (Bhutan) animal occurs at the extreme eastern end of the Himalayan ranges, which here trend east and west; the most eastern animal is found at the western end of the Tsin-ling ranges, which also trend east and west, but its area of distribution in Shensi is probably much less restricted than is that of the Bhutan takin. The intermediate areas are all on north and south trending ranges.

The Ssuchuan takin, known for many years, and shot by no less than three Europeans in 1908 (Mr. R. W. Zappy, Mr. C. H. Mears and Capt. Malcolm M'Neill) originally described as *B. taxicolor var. tibetana* was subsequently raised to specific rank under the name *B. tibetanus.* This animal inhabits the high mountain ranges of far Western Ssuchuan, the Tibetan Marches, geographically related to the parallel mountain systems of Burma, and S. E. Tibet. *B. bedfordi* obtained from the Tsin-ling is another animal altogether. As far as I know, there was never any question of its being a mere colour variety of *B. taxicolor* though obviously a close ally.

According to Mr. E. H. Wilson, however, who has perhaps seen more takin skins than anyone else, these animals vary so enormously in coloration, that it is still an open question, which are varieties and which species."

The only even moderately well known takin are those of Bhutan and W. China, from the two most widely separated areas; and these are the types of the three species. Those known from the parallel ranges in the Sino-Tibetan area are all referred to *B. tibetanus,* which is certainly very close to *B. taxicolor.* This suggests that the Shensi animal has been long isolated, while those of the Sino-Tibetan area have been recently, or even still are in communication with those of the Bhutan area. It also suggests that the parallel ranges of the Sino-Tibetan area are more closely related to the Himalayan ranges than they are to the ranges of mid-China.

But the whole of this great area from the Brahamaputra to the Yalung is so little known, that the present apparent discontinuity of distribution may easily turn out to be exaggerated. Indeed there is no reason why *B. taxicolor, B. tibetanus* and *B. bedfordi* should not be mere colour varieties of the same animal, of which the intermediate forms have not yet been found; though such a verdict need not invalidate the above argument.

We now come more directly to Mr. Mill's animal. It is evident that there is no obstacle to migration down one of the parallel ranges stretching south between the Brahamaputra and the Yalung river, so long as the necessary conditions are fulfilled. Major Bailey's Tibetan takin were shot, I believe, somewhere near Drowa-gompa on the Salween-Zayul divide, and there is nothing to prevent an animal migrating from there S.-W. into the Naga Hills, passing along the range between the Zayul valley and the headwaters of the Mali-hka; or due south down the range between the Hukong valley and the Mali-hka. There is indeed no reason why takin should not be found on the ranges between the Mali-hka and the

Nmai-hka. In fact the remarkable thing to my mind is, not that this weird animal should crop up here and there, but that it should have escaped the observation of sportsmen so long. But of course the N.-E. Frontier is a *terra nova.*

It must be remembered, however, that the mountain ranges mentioned above carry few peaks above 10,000 feet, and that takin are likely to be confined to special localities.

The existence of takin over a considerable length of the Salween-Irrawaddy divide is proved. When I was at Chamutong, in the Upper Salween valley (latitude 28°), in 1911, I saw skulls, which had come from the mountains to the west, where the takin is regularly hunted. Mr. C. C. Lowis got one in Mekh valley, N.-E. Frontier, in 1913 ; and I saw a herd of seven not many marches from Hpimaw in 1914.

After crossing the Salween valley, however, there is a big break in the continuity ; and it is not till we have got far into the north-east that takin re-appear.

The reason for this may be guessed. The takin is an animal of the high mountains. In summer its limit is probably not less than 10,000 feet though it may descend considerably lower in winter especially in such a country as the N.-E. Frontier, with its heavy snowfall. But altitude is not everything and I have come to the conclusion that the presence of much bamboo growth at high altitudes whether for shelter or food—is essential to the takin's existence.

If this is so we can easily mark out the probable limits of the takin's distribution and say where it is most likely to be found ; and so far all the available evidence points to the above conclusion or something very like it.

Thus we should not expect to find takin on the high but dry and rocky Mekong-Yangtze divide, nor north of the sources of the Zayul and Taron rivers, in S.-E. Tibet. It is not until we get right away up into N.-W. Ssuchuan, where a well distributed annual rainfall again covers the mountains with bamboo and Rhododendron forest, that this animal reappears. The mountains of Shensi at 10,000 feet are similarly clothed with bamboo, Rhododendron and Conifer forest. Whether the mountains of the Kansu-Tibet Frontier also harbour the takin has yet to be proved, but I see no reason to doubt it will eventually be met with there too ; it is not an animal that fears even the severe cold of a Kansu winter.

In the same way takin should come to light on the high range between the Brahamaputra and the Dibang, and again between the Dibang and the Zayul river.

We have now answered the two questions originally put, and I might sum up my opinion as follows. I am a firm believer in Mr. Mills' takin, which is probably *B. taxicolor,* but might prove to be a local variety ; these animals have probably migrated from Zayul province.

In view of the great interest attaching to the geographical distribution and variation of an animal like the takin whose habits and mode of life in the wild state are practically unknown, any further light which can be thrown on the matter by observers such as Mr. Mills would be most valuable.

F. KINGDON-WARD.

BELGAUM, 8*th March* 1919.

No V.—NOTES ON THE BIG GAME AND DUCK OF DHAR STATE.

Tiger (*Felis tigris*).—Confined to the reserved forest tract (Shikar preserve) on the banks of the Narbadda. Majority of tigers shot measure 9′-6″. A fine tigress shot by my wife in 1914 measured 9′-10″. I think it is a good size for a tigress.

Panther (*Felis pardus*).—Very common in the State; from the records kept of panthers shot the following observations are made.

The larger variety is more common than the smaller. The following measurements will show the differences—

8ft.	7ft.	6ft.	5ft.	Mis.	Total.
8	36	49	3	10	106.

Habitat—They are common in the hills everywhere but now very rarely come, in broad day light, near a town or on to the plains as they used to do in the eighties, when they were thus shot in the open by sportsmen. The last shot in this way was at 7 a.m. in the month of March 1908.

Mention of particular instances.—My wife shot a panther over a kill at night on the 13th September 1918 which was found next morning dead, with one of his legs and portion of his right side up to the breast eaten by another panther. Over the same kill three more panthers later appeared and ate what remained.

On the 30th of November 1918 my wife shot a panther which measured 8′-2″ when found dead next morning, so it must have measured at least 8′-4″.

The biggest panther on record was shot in the State in November 1908, three miles from Dhar city. He was an old and well marked animal with big spots.

An old muzzle loader bullet was found in his nose when skinned. I venture to think that this panther was not only a record in Dhar State but must be at least one of the best shot in India, as I have faint recollections of once reading in a newspaper, some years back, that a 9′ panther was shot in Assam or somewhere about there.

Sloth Bear (*Melursus ursinus*).—Not common. Confined to the tracts along the Narbadda river. They were common in 1850 and 1870 below the foot of the Mandu hills (part of the Vindhya range).

The biggest bear, shot up to now, measured 7′-9″.

Sambhar (*Rusa equinus*).—Not very common in the State. They are confined to one locality on the banks of Narbadda in the reserve forest. The biggest head was shot (by me) in 1914; the right horn measured 46′, the left 44½″ while the spread was 44″. Another fine head was shot in the same month which measured 36½″, another head picked up in 1908, belonging to an animal killed by a tiger, measured, left horn 38″ and right horn 34½″ (partly broken) spread 29″.

Since 1916 Sambhar have again commenced to appear in the hills of the forests round Mandu.

Chital (*Axis axis*).—Remarks the same as for Sambhar, the best head shot in these tracts up to now measured 36″.

Blue Bull (*Beselaphus tragocamelus*).—Confined to tracts on the banks of the Narbadda. Two heads shot by me measured 10½″ and 9½″ and two by my wife 8¾″ and 8½″, respectively.

Black-buck (*Antilope cervicapra*).—Throughout the Malwa plateau portion of the State, and are abundant. The biggest head was shot in 1916, 3 miles from the town. The right horn 27½″ and the left 27″.

Another head was shot in 1916 which measured 25½″, one of 24″ in 1915 and a fine head in November 1918 which measured 26″. On the western and eastern sides of the plateau, heads between 21″ and 25″ are common.

Chinkara (*Gazella bennetti*).—Since 1915 they have appeared on the Malwa Plateau portion of the State and are also abundant in Nimar, *i.e.*, tract below the ghats and on the banks of the Narbadda.

Two good heads shot there, measured 12½″ each.

Four-horned antelope (*Tetraceros quadricorus*).—My remarks are same as for Sambhar, Chital, etc. Two heads were shot in 1911 which measured 3½″ each.

Habitat.—Very rare in the State.

Duck.—The following vernacular names which are commonly used by local Bhois (Kahars) to distinguish species of duck, which are annual visitors to the State may interest readers:—

Brahmini Duck, *Cascara rufila*	♂ Chackwa Chackwi चकवा चकवी.
Comb Duck, *Sarcidiornis melanonotus*	Nakta. नकटा.
Whistling Teal, *Dendiocyna javanica*	Chui. चुइ.
Cotton Teal, *Nettopus coromandelianus*	Gengat Gurra गेंगट गुर्रा.
Grey Duck and spotted bill, *Anas pœcilorhyncha*.	Ghagral (one of the varieties) घगराल.
Teal of all kinds, *i.e.*, Garganey, etc., are called by one name	Patra पत्रा.
Wigeon, *Mareca penelope*	Titry तीत्री.
Pintail, *Dafila acuta*	Lampuchi (long tail) लमपुछी.

N.B.—It is very surprising that the Bhoi-Kahars of this place will always call "Wigeon" as Lampuchika Naroka, *i.e.*, male of Pintail, though these two varieties are absolutely different and have no connection with each other whatsoever.

Gadwall, *Chaulelasmus streperus*	Kalpuchhi (Back tail) कलपुछी.
Shoveller, *Spatula clypeata*.	Chapti Chochka Patra "Flat billed teal". चपटी चोचका पत्रा.
Mallard, *Anas boscas*	Called Hari-Garden Ghagral, *i.e.*, green headed, हारी गारदन घगराल.
Red crested Pochard, *Netta rufina*	Singbaj सींगबाज.
Pochard, *Nyroca ferina*	Bhetia (Lalsar) भटीया (लालसर).
White-eyed Pochard, *Nyroca africana*	Katakabri. कटकबरी.
Tufted Duck, *Fuligula fuligula*	Kabra "Variegated" "Pied" कबरा.

UDAJI RAO PUAR, K.C.S.I., K.B.E.,

Maharaja of Dhar.

DHAR, C. I.,
6th January 1919.

No. VI.—VARIETY OF THE COMMON HOUSE CROW. (*CORVUS SPLENDENS*) AT JHANG, PUNJAB.

In the Journal of the Society (Vol. XXVI, 290), I described a variety of the Common House Crow and remarked that a second bird somewhat similar was frequenting the same place. This second bird I had not intended to kill but on 5th December 1918 it was shot by a sportsman and brought to me. I accordingly now record its description:—

Forehead, nasal tufts, anterior half of the sides of the face, chin and throat (*i. e.*, the usual mask) chocolate brown, slightly darker in tint than any other portion of the plumage. Nape, remainder of sides of face and neck, white, merging imperceptibly into creamy white on the breast.

Remainder of plumage creamy brown, slightly motled in appearance due to the presence of irregularly scattered feathers of a darker tint.

Iris dark brown ; bill and legs dark chocolate brown. Organs not distinct, but apparently a female. Just completing entire moult.

HUGH WHISTLER, F.Z.S.,

JANG, PUNJAB. INDIAN POLICE.

[There are in the Society's collection two very similar specimens.—EDS.]

No. VII.—MATERNAL INSTINCT IN THE PIED BUSH CHAT (*PRATINCOLA CAPRATA*).

The probability that a bird will desert its nest and eggs if disturbed is often mentioned and is a fact well known. I once found 12 nests of Tickell's Staphidia (*Staphidia striata*) within a space of 20 yards all deserted and many with addled eggs therein. The opposite is not so often told. A Pied Bush Chat laid her eggs this year in a rusty old kerosine tin lying on the ground behind the line of Railway carriages occupied by visitors to Kalate. The tin was frequently picked up and carried about to show off the nest. The bird was caught by a servant and tied by the leg to his mistress' carriage and she nursed and fondled it. When let go the bird returned to its nest. The tin was brought to show me some days later, the bird flying off the nest at the time. I took a Cuckoo's (*Cuculus canorus*) egg out of the nest. In spite of these frequent attentions the bird still sat. Two days after I first saw it there were two more Cuckoo's eggs in the nest. The small bird has had her reward. She has hatched her brood and been spared the cuckoos. As an instance of strong maternal instinct this may deserve to be recorded.

S. M. ROBINSON.

RANGOON, 1*st May* 1919.

No. VIII.—NESTING HABITS OF THE BROWN ROCKCHAT (*CERCOMELA FUSCA*).

I was much interested in Mr. L. S. White's letter in the last issue of the Journal for May 1919, regarding the nesting habits of this bird. During four years residence in the United Provinces my experience exactly coincides with his. The Brown Rockchat is one of the most familiar birds of the bungalow and is doubtless often mistaken for the Brown backed Indian Robin, *Thamnobia cambaiensis.* A favourite nesting site is the ledge that often runs round the top of the wall inside the bungalow, about 3 inches or so below the level of the ceiling: and corners of shelves in the disused rooms are also very frequently used.

The nest is always surrounded by and on the top of a small heap of stones collected by the bird. Pits of broken earthenware pots seem to be the favourite material and some of the pieces are so large that it is a marvel how the bird carries them. One piece I measured was 2½ × 2 inches and about ¼ in thick: and this particular nest had between 50 or 60 such pieces all round it. The next was in a corner of the shelf in the office that had 5 people working in it all day, and the birds showed absolutely no fear, coming to feed their three-quarter pledged young about once in every minute. If unmolested these birds will build in the same shelf year after year, and sometimes make a new nest in the opposite corner of the shelf.

W. H. MATHEWS.

RUNGLI RUNGLIOT,
DARJEELING, 10*th July* 1919.

No. IX.—AN ALBINO SWALLOW.

On 2nd July I procured an albino swallow which on examination is, I think, a specimen of Hodgson's Striated Swallow *Hirundo nepalensis*. Some of the measurements are wing 4·6: bill from Gaps about 5·5: tarsus ·5: iris pink.

The colour is pure white but some of the inner webs of the secondaries are tinged with buff, also the tail feathers. Unfortunately the bird was rather damaged when I shot it and the skin is a very poor one: however I enclose it for what it is worth.

W. H. MATHEWS.

RUNGLI RUNGLIOT, P. O.,
DARJEELING, 10*th July* 1919.

No. X.—ABNORMAL VARIETY OF THE GREEN BEE-EATER (*MEROPS VIRIDIS*).

On 9th June 1919 I obtained an abnormal variety of this bee-eater at Thang, Punjab. The Bird was a female and one of the recently fledged brood.

The entire plumage is of a soft creamy white which assumes its darkest and most dusky tint on the secondaries. A narrow supercilium and the throat are washed with yellow which is palest on the centre of the throat. The feathers of the crown, nape and breast are lightly washed with yellowish green.

The feathers of the wing-coverts, scapulars, back, rump, and upper tail coverts are lightly edged with greenish or yellowish buff, imparting a slightly mottled appearance to those parts. There is a faint blackish bar across the ends of the secondaries.

Iris grey: orbicular pale olive flesh colour. Bill and legs fleshy whitish horn.

HUGH WHISTLER, F.Z.S.,
INDIAN POLICE.

THANG, PUNJAB, 20*th July* 1919.

No. XI.—SOME BIRDS OF PREY OF MESOPOTAMIA.

A couple of months in any country does not go very far to enable one to study the fauna of that country, especially when one is tied to an office stool for the greater part of the day, but on the principle of "every mickle making a muckle" I venture to give below a list of the Birds of Prey I came across during my short sojourn in Basra, including a hurried trip to Bagdad (during period 18th October to 6th December 1918).

Most of my early mornings, from 6 to 8 a.m., were spent in the environments of creeks and palm groves, with nets, nooses and a rat or a sparrow, by way of bait, in quest of Accipitrine birds generally, and the Barbary falcon in particular, but so far as the latter was concerned I had no luck whatever. I saw it on several occasions, but invariably on the move and never had an opportunity of setting my nets. In Ashar, there was one to be seen almost every afternoon perched high up on the mast of the wireless, but in such a position that it was almost impossible to find a place whereon to set a trap.

Around Basra itself I came across the following species :—

1.	Imperial Eagle. — *Aquila heliaca.*	A single specimen in the lineated plumage, observed twice near Makina, in the end of October. Besides this, I saw another a few miles up river from Shaikh Sad. It had put up a hare among some scrub and was stooping at it in great style and turned the hare out of cover several times. It was in plain view of the steamer as we went up river and I watched the chase with my glasses for about quarter of an hour and as we turned the corner it was still stooping, so what the ultimate result was I never knew. It was a very fine specimen in adult plumage and I should think a female, judging by its immense spread.
2.	Large spotted Eagle —*Aquila maculata.*	One specimen arrived towards the end of November and took up his quarters in the palm groves behind the 3rd Echelon where I frequently saw him.
3.	Boated Eagle—*Hierætus pennatus.*	I frequently saw a pair of these birds and caught a male. Both in the light phase of plumage.
4.	Black Kite—*Milvus migrans.*	Extremely common everywhere.
5.	Pale Harrier—*Circus macrurus.*	I saw one specimen which I am almost certain was a Pale Harrier, near Mohamerrah on 18th October.
6.	Marsh Harrier—*Circus æruginosus.*	Not uncommon. I saw them at old times near Makina and as far up as Amarrah.
7.	Long-legged Buzzard—*Buteo ferox.*	This species is very common. I caught two in the dark plumage and two in the light, and saw several others. I was on the look out for *B. desertorum* but never came across one.
8.	Sparrow Hawk—*Accipiter nisus.*	I saw several specimens at Basra and Bagdad.
9.	Peregrine Falcon —*Falco peregrinus.*	Seen twice at Makina.
10.	Barbary Falcon --*Falco barbarus.*	Not uncommon. Appears to be somewhat crepuscular in its habits. Sits on the ground about sunset apparently watching for bats.

11. Hobby—*Falco subbuteo.*	I cannot be absolutely certain but am almost sure I saw this species once, late in the evening. It might have been "barbarus," but the flight and mode of hunting was that of a hobby.
12. Kestrel —*Tinnunculus alaudarius* or Lesser Kestrel—*T.cenchris.*	I could not be sure which, but one of the Kestrels it certainly was. I saw one flying at a height over Ashar and another at Bagdad.
13. Saker Falcon—*Falcon cherrug.*	I saw one strike a sandgrouse near Shaik Sad on the bank of the Tigris. It had to give up its prey to a Steppe Eagle.
14. Merlin—*Æsalon regulus.*	One pair took up its quarters in the palm grove behind the 3rd Echelon. They hunted singly and might be seen any morning or evening beating over the groves, but never together. On 3 occasions I visited the grove during the day and found both, though not together, but within a short distance of each other, resting for the day.
15. Steppe Eagle—*Aquila bifasciata.*	The only one I saw was the one mentioned under the Saker Falcon. A typical one with the lines on the wings very well defined.

There was one other bird which I failed to recognise, although I saw it twice. In size, shape and flight and colouring it closely resembled *Aquila vindhiana* and had I seen the same in India, I should have unhesitatingly put it down as a Tawny Eagle, but as this species is not supposed to occur outside of Indian limits and as I did not get to within a hundred yards or so of it, I omit it from the list.

C. H. DONALD, F.Z.S.

DHARMSALA CANTT.,
2nd February 1919.

No. XII.—EXTENSION OF RANGE OF THE GREEN IMPERIAL PIGEON (*CARPOPHAGA ÆNEA ÆNEA*) IN WESTERN INDIA.

The Green Imperial Pigeon, *Carpophaga œnea œnea,* according to Mr. Stuart Baker in "Indian Pigeons and Doves," is not found further north in the Bombay Presidency than the north of North Kanara. He does, however, not make any mention of the skin in the British Museum labelled "Bombay" and presented by Col. Sykes of which Blanford in the 4th Volume of the Fauna of British India writes in a footnote as follows :—

"There is in the British Museum a specimen labelled Bombay from Sykes's collection, but the species is not recorded in Sykes's list, and a specimen of the Himalayan *Dendrotreron hodgsoni,* also from Sykes's collection, occurs similarly labelled. Butler, in the '*Bombay Gazetteer*', says that *Carpophaga œnea* was included in Major Lloyd's Konkan lists and that he may have seen it once himself at Khandala. But neither Fairbank nor Vidal records it."

It is therefore interesting to be able to record that a skin of this pigeon, shot on Tungar Hill near the Bassein Road, B. B. & C. I. Railway station, 34 miles north of Bombay, on 19th January 1919, has been presented to the Society's Museum by Mr. M. Frei. This was the only specimen obtained by Mr. Frei, but he writes that several birds were seen.

N. B. KINNEAR.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY, *30th January* 1919.

No. XIII.—EXTRACTS FROM "A MONOGRAPH OF THE PHEASANTS BY WILLIAM BEEBE."

As these extracts may be of interest to Entomologists and others who have not access to the above fine and expensive work, I have copied them out and send them along.

Under "Daily Round of Life" of the Himalayan Blood Partridge (*Ithagenes cruentus,* Hardw.) on pages 10, 11 of the above volume the author writes :—"Once in Nepal close to the Sikhim line, I found a family of five Blood Partridges feeding in a most interesting way. The region was devoid of all but grassy vegetation with a few scattered clumps of low barberry bushes. A heavy snow fall, unseasonable, as it was mid April, had covered the ground and hidden all the seeds and leaves of the low-growing plants. What I had not noticed during previous days was now made conspicuous by the back ground of snow the abundance of clumps of tall stems, each topped with the seed-case of a last year's lily. These three-parted, brown and brittle cups showed where in past months had bloomed scores of red and yellow blossoms. I was able to watch the feeding Partridges for only a few minutes before a Raven discovered me and croaked his disapproval, sending the covey scuttling off along the hillside and over the nearest ridge. At the same time a flock of pipits and finches flew up and away.

The snow was soft and I read in its surface the confirmation of what I had observed. The Partridges had appeared to be leaping up at the seed-cases, or pressing against and bending down the stems. I carefully examined many which had been thus disturbed and found that there was good reason for these actions.

The fierce gales and winds of the past winter had tipped and swayed the lily-seed goblets, and the flat, reddish seeds had been scattered over moss and snow, skimming along on their circular wings for many yards around. But with all this upsetting, only about half the seeds had been shaken out. I have spoken in a previous paragraph of the insect life which was noticeable even after a heavy fall of snow and I found that one secret of their presence was the half-emptied seed-cases, which, on these high, treeless barrens, formed safe and snug retreats. Into one case a rove-beetle had crawled ; into another a small moth, although, owing to the number of seeds still remaining, the tips of the insects' wings protruded from the top. Here two tiny flies were resting, hardly able to use their legs, much less their wings, in the chill of the morning. There is no doubt but that these insects remain in their retreats in a state of semi-frozen hibernation until the return of more seasonable weather.

When the snow and ice covered thickly all other food, the Blood Partridges found here bountiful feast, both of seeds and insects in the lily cases. The maze of tracks revealed the patience and activity of the Partridges in levelling the stems, while in a wider circle around the scene of action the dainty footprints of skylarks, pipits, finches were everywhere interlaced showing that they had learned how to secure a portion of the stray seeds which were thrown upon the white surface from the efforts of the Partridges.

When I found that this habit of the Partridges was common to the several flocks which I had the opportunity of observing, I realized how it was possible for these birds to remain at such high, barren altitudes when all other sources of nourishment were sealed by frost and snow. I investigated the seed-cases of a half dozen lily clumps four hundred yards apart with these interesting results—

Nine were empty except for a scattering of seeds.

Twenty-six held a single earwig each.

Four held two earwigs (in three instances both insects were in the same partition).

One held an earwig in one partition, and a ladybird beetle and a dipterous larva in another partition.

Three held similar dipterous larvæ.

One held a small spider and two small flies.

Five held rove-beetles of two species, one of which proved to be new.

Eight held small chrysomelid beetles.

One held a chrysomelid and a carab beetle, a weevil and a small grey spider.

Two held small moths.

One held a small moth, a mosquito, and a homopterous insect.

Thus almost fifty per cent. of the seed-cases contained one or more earwigs, and some of these, as well as others of the insects, were heretofore unknown species. The conditions at the time of collecting these were as follow. At this season, mid-April snow covered the ground deeply and remained unmelted for three days. The preceding week had been warm and clear, and insects were abundant, and all those now found in the seed-cases were alive, although too numbed to fly or to do more than move their legs weakly. In no instances were more than half the seeds remaining in the cases, and where the stems were thin and more pliant, almost all the seeds had been thrown out during the winter. The lily clumps were large and a dozen or more stems sprang from a circular mass of dead, prostate, whitened leaves, the whole forming a mat about a yard in diameter. At this season new leaves were sprouting, and before covered by the snow, showed as straight, vertical, green shoots several inches in height.

TEXT IDENTIFICATIONS.

Page.	Line.	
10	21	Himalaya Raven, *Corvus corax tibetanum*, Hodgs.
11	12	Earwigs, *Homotagesfeœ* (Bormans). *Forficula planticollis*, Kirby.
11	14	Ladybird Beetles, *Coccinella 7-punctata*, Linn.
11	17	Two small flies. An undescribed *Criorhina* and a number of the *Cordyluridæ*.
11	18	Rove Beetle, *Osonius belbei*, Beurh.
11	19	Chrysomelid Beetles, *Trichotheca hirta*, Baly.
11	20	Carab Beetle, *Opisthius indicus*, Chaudoir.
11	20	Weevil, *Tanymecus* sp.
11	21	Moth, A *noctuid*.
11	22	Homopteron, of the family *Jassidæ*."

BAGHOWNIE FTY., LAHERIA SARAI, CHAS. M. INGLIS, M.B.O.U.
13th July 1919.

No. XIV.—THE BLACK-BREASTED KALIJ PHEASANT (*GENNÆUS HORSFIELDI HORSFIELDI*) EAST OF THE IRRAWADDY.

Through the kindness of Mr. B. B. Ormaston I have received a fine specimen of this pheasant obtained S. E. of Myitkynia on the East bank of the Irrawaddy and at an elevation of 3,000 ft. in January 1916. Although Mr. Stuart Baker gives Myitkynia as one of the localities in which this species (type specimens of *G. batenani*) has been got, yet being on the eastern border of this bird's habitat I consider it interesting enough to record. I may mention that the central rectrices are slightly vermiculated near their bases though the bird is fully adult.

BAGHOWNIE FTY., LAHERIA SARAI, CHAS. M. INGLIS, M.B.O.U.
11th March 1919.

No. XV.—A NOTE ON THE BREEDING OF THE HILL PARTRIDGE (*ARBORICOLA TORQUEOLA*) NEAR SIMLA.

So little appears to be known regarding the breeding of this common but little observed bird that it is of interest to set on record some particulars of a nest which was recently obtained for me about 8,500 ft. near Mahasoo, Simla, by a valued correspondent this year.

The nest was found first on 25th April through the flushing of the parent birds, but although they had betrayed the approximate whereabouts of the nest, it was discovered only after a careful search; there were then 7 eggs, on the 27th April there were still only 7 eggs, but 8 were found the next morning. When the place was again visited on the 2nd May it was found that another and last egg had been laid, making in as a clutch of nine. On each of these subsequent visits neither parent wall seen and the eggs were invariably cold, yet from the placing of grass over the entrance hole there was no doubt that the eggs were not deserted.

As I had insisted on the necessity for complete authentication of the eggs, endeavours were made to snare a bird at the nest but a first attempt with horse hair nooses was unsuccessful; so on the 7th May a gut noose was set and the nest was visited a second time in the evening. There had been a hail storm and hail stones then lying thickly around; my correspondent on arriving at the nest was astonished to find it completely covered over with grass and while he was looking at this and wondering at the reason the bird suddenly bounced out and as it passed he made a lucky grap and caught it in mid air in his hand; the broken gut snare was then round its neck. He kept the bird and set a fresh noose in the entrance and this had been disturbed next morning though the second bird was not caught. The eggs were then taken for me.

The nest is described as being built in a carefully scraped out and rounded hole in a bank; this hole measured 8½ inches in diameter after the removal of the nest, which was built carefully of, and domed with, grass with an internal diameter of 6½ inches. The actual site of the nest was fairly open, but only a few yards away started under-growth of the type usually frequented by the Peora. Particular emphasis is laid on the facts that whenever the nest was visited the eggs were quite cold, and on the fact of concealing the entrance of the nest with grass whether the bird was sitting or absent.

The eggs when blown were found to be all slightly incubated to an equal extent. They are in shape of a very pointed oval, verging almost on the pyriform, of a very fine texture, faintly pitted, and with a rather pronounced gloss. The colour is an almost pure white, with no marking. The nine eggs measure from 42·5 to 46 mm. in length and 32·5 to 34 in width; the average comes to 44 by 33·2 mm.

HUGH WHISTLER, F.Z.S.,
INDIAN POLICE.

JANG, PUNJAB, 20*th July* 1919.

No. XVI.—LATE STAY OF COMMON SNIPE (*GALLINAGO CŒLESTES*) IN CENTRAL INDIA.

Snipe have stayed here very late this year. As a rule there are no snipe in the tanks round Indore, after the end of March. This month I have shot snipe on the 7th, 17th and to-day, thus—

On the 7th ..	.. 5 fantail.
„ 17th ..	.. 2 fantail and 1 jack snipe.
„ 21st ..	.. 3 fantail.

There are blue winged teal here, but they always stay till the end of April and beginning of May.

INDORE, 21*st April* 1919.

PERCY HIDE.

No. XVII.—LATE STAY OF PIN-TAIL SNIPE (*GALLINAGO STENURA*) IN BURMA.

While I was on tour the other day at a place called Natogyi, where there is a large tank (natural) of foul stagnant water, I shot a Pin-tail Snipe (*Gallinago stenura*) on the evening of the 6th May. When I first saw the bird it was standing at the very edge of the water, much in the same way as a pond-heron does, in an attitude of keen attention, apparently on the look-out for some water-insect or worm. I got quite close before it flew. A little further along the tank I saw another in exactly the same attitude at the edge of the tank. I got quite close to this one too before it flew off, but I missed the bird. I saw no more birds . . . . . This is the Dryzone of Burma, and from the middle of February till the rains break it is very hot. May is probably the hottest month. Is it not very late to find Snipe? Is there any record of Pin-tail Snipe breeding in the plains? I hunted for a nest without success. The bird was in very good condition.

A. F. M. SLATER.

MYINGYAN, UPPER BURMA,
15th May 1919.

No. XVIII.—MIGRATION OF SNIPE IN BURMA.

My shikar books show the following on the subject of Snipe:—(I arrived in Burma on 13th September 1913.)

The first snipe-ground was found 30 miles W. of Yaunghwe in S. Shan States Birds were "fairly plentiful and appear to be travellers"—"Pin-tails."

This is perhaps important. East of a line Yaunghwe-Lorkaw (100 miles S.) the country is a mass of hills with hardly any ground in it to tempt a snipe down.

Birds were still "fairly plentiful" all the way down the river at Lorkaw.

On 2nd October (1913) I have an entry: "The snipe must be coming in . . . . I got my first fan-tail to-day."

But you will note that I had only just arrived in the country, and had nothing to "watch for," knowing nothing of the district.

I shot a bag of 53 couple at Lorkaw on 23rd February 1914.

"The number of snipe about seems to be on the increase." Probably they are moving back North. Fans and Pins mixed.

I left the district temporarily about middle March.

Winter, 1914-15.

"2½ couple of Pin-tail to-day. There is a small number of birds about . . . . 17th August 1914 . . . ." I had naturally not been shooting much—or leaving the telegraph office much—as in those days we all hoped for recall.

My first fan-tail shows on 7th September 1914: "there are a few fan-tails about now."

There is a gap of some days towards the end of the month, but on 4th October I have an entry: "A whole rush of birds seems to have come in with the moon." Later, in the middle of December (1914) I have: "The snipe seem to have fallen off and it seems to me that most of those travellers have gone—probably South. The local mass is useless regarding habits of snipe as they are too small and elusive to warrant the expenditure of powder and shot. But it seems to me that they travel largely with the moon of Tha-din-gyut, *i-e.*, say the first moon after 20th September.

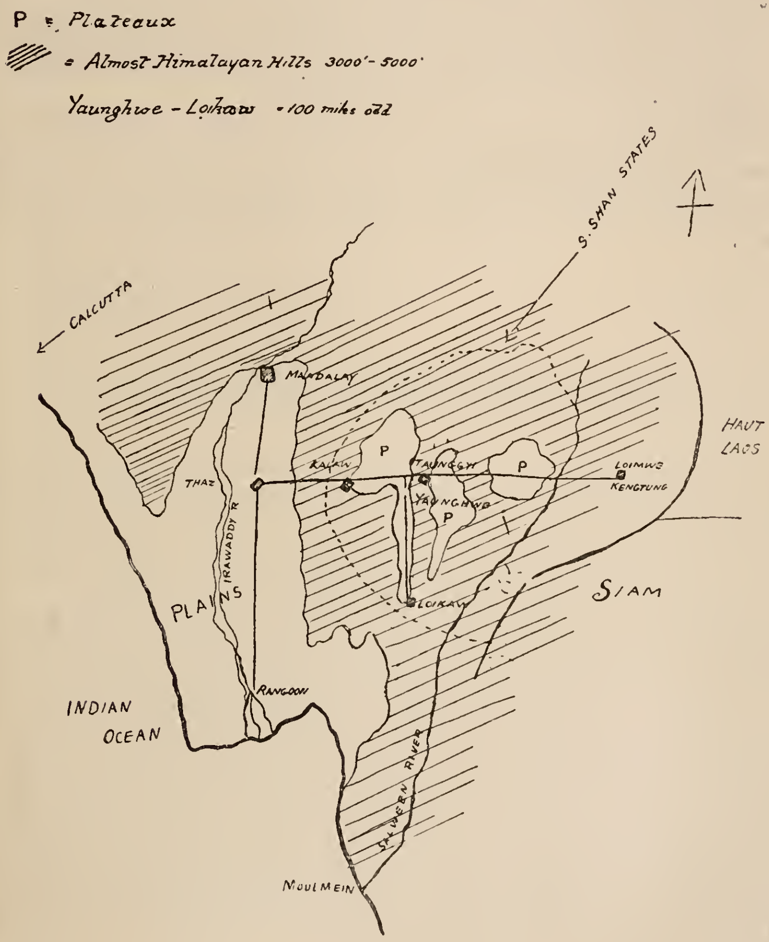
November and December were quiet months. There were always plenty of snipe, but I never noticed a larger quantity than usual. During February I did —probably the Southern birds going back.

I shot consistently, till 13th May I mean. In middle April I have an entry: "I'm afraid the snipe will soon be gone...."

Re the last bird 13th May. I have "The bird—a pin-tail—seems quite true and examination shows no sign of its having been touched up by a pellet.

Winter, 1915-16.

My first bird was on 4th August. "2-couple of pin-tail to-day. I had no idea they'd be in so soon—or I'd have gone out earlier. The birds are in good condition and may have been here sometime....."


P = Plateaux
= Almost Himalayan Hills 3000'-5000'
Yaunghwe - Loikaw = 100 miles odd
S. SHAN STATES
CALCUTTA
MANDALAY
THAZ
KALAW
P
TAUNGGYI
P
LOIMWE
KENGTUNG
YAUNGHWE
P
HAUT LAOS
IRAWADDY R
PLAINS
LOIKAW
SIAM
RANGOON
INDIAN OCEAN
SALWEEN RIVER
MOULMEIN

I shot only another dozen couple or so before I went into head-quarters and got no shooting. I was away from the snipe-ground again at the close of the season—*i. e.*, after February 1916.

Winter, 1916-17.

I got no chance of shooting anything till 17th August, when I picked up 3½ couple of pin-tails. The fan-tails made their first appearance (as far as I was concerned) on 15th September. I returned to India before the close of the season.

To sum it all up :—

I am of the opinion that pin-tails may be expected in Lorkaw from 1st August annually. Fan-tails from 1st—10th September :—about a month later.

That the pin-tails move—in the majority—southwards with the first moon of October, re-appearing about 1st February. That the fan-tails about 1st February. That the fan-tails don't move much after arrival at Lorkaw.

That both kinds are on the move homewards from 1st March onwards—most being gone by 20th of the month. A few stay another few weeks.

Lame birds stay throughout the summer. Painted snipe undoubtedly breed there.

The geography of the surrounding country makes one think that the Yaunghwe-Lorkaw valley is regarded as the first "Long halt" for Pin-tail who come in probably from N.-E. From the enclosed rough map you may be able to gather that most of the country East and North-east of that line is all hills, and unlikely to prove suitable stopping places for birds *en route.*

E. T. KENNY.

RANGOON.

No. XIX.—FEEDING HABITS OF THE LITTLE EGRET (*HERODIAS GARZETTA*).

I witnessed this morning what appeared to me a rather astonishing performance on the part of a Common White Egret (Paddy bird or Bogla). When I first noticed it, it had caught either a chameleon or some lizard at least a foot long. This creature was struggling furiously in the Egret's bill. It repeatedly succeeding in escaping but was always recaptured after running a few yards. After a bit its struggles became feeble, and I noticed that it was then always caught by the head, whereas at first the bird caught it by any portion of the body it could catch hold of. The Egret now started to try and swallow its head first. The head and front legs went in, but it began to struggle furiously with its hind legs and long tail sticking out. The commotion that went on in the bird's neck was now extraordinary to witness. It looked as if the lizard's head or legs must break out through the neck. Several times a black patch appeared on the neck of the bird which looked like the lizard's head coming through, but it was only that the skin was stretched very tightly and the colour of the lizard or skin showed through the feathers. At last after fearful efforts the hind legs also went down. The bird then stood working its neck, in which the bulge could still be seen, up and down for about ten minutes. After that it flew away none the worse. When the bird stood holding the lizard in its bill the latter looked quite as long as the bird itself and I would never have believed it could have been swallowed.

H. R. MEREDITH.

KHUNTI RANCHI DISTRICT :
CHOTA NAGPUR, 13*th May* 1919.

No. XX.—FURTHER OCCURRENCE OF THE ROSE-COLOURED STARLING (*PASTOR ROSEUS*) AND THE FLAMINGO (*PHŒNICOPTERUS ROSEUS*) IN THE DARBHANGA DISTRICT, BEHAR.

Four flamingoes were brought to me on the 1st February this year and they had evidently been snared in some adjoining jheel. The first and last record of this bird from near here was of three brought in on the 22nd November 1907, and already recorded in No. 3, Vol. XVIII, p. 683 of this Journal. This bird must be exceedingly rare here and seems to only occur in small parties at long intervals.

On the 31st January this year, I shot a single specimen of the Rose-coloured Starling. It flew up from a Chilli field, where it had been feeding on the chillies. It was by itself, but there were specimens of the Pied Myna (*Sturnopastor contra*) feeding not far off. This is also a rare bird here, and the last record I have of it appear to be the 12th March 1909.

CHAS. M. INGLIS, M.B.O.U.

BAGHOWNIE FTY., LAHERIA SARAI :
BEHAR, 11*th March* 1919.

No. XXI.—DIFFERENT BIRDS NESTING IN COMPANY.

There is in my compound a palm tree, the name of which I am afraid I do not know, which has the following nests in it :—

Common Myna, 2 nests with young.
Bengal Red-vented Bulbul with young.
Ashy Swallow Shriks with young.
Spotted Munia building.
Magpie Robin with eggs. The leaves of this tree form natural hollows where they join the trunk and are ideal nesting sites. The tree is about 35 feet high.

W. H. MATTHEWS.

RUNGI RUNGLIOT P. O. :
DARJEELING, 10*th July* 1919.

No. XXII.—NOTES ON SOME NESTS RECENTLY FOUND IN SOUTH TENASSERIM.

I hope at a later date to be able to publish a full list of the birds met with during my residence in South Tenasserim, but it seems desirable to record, without further delay, these notes on the nidification of certain species, concerning which the information is at present very meagre.

21. Black Racket-tailed Magpie.—*Crypsirhina varians.*

These birds are common throughout the Tavoy and Mergui districts wherever the forest is of a fairly open type, and where there is a preponderance of bamboo : they are not found in heavy evergreen jungle. The nests are built, as a rule, in bamboo clumps, at a height of about ten to twenty feet from the ground, and are composed of twigs, and often, but by no means always, lined with tendrils. The normal clutch appears to be three, but I have found only two incubated eggs, and very occasionally four are laid. There is nothing to add to the description of the eggs given by Hume, and all the eggs taken by Mackenzie (who was with me in 1918), and myself fail within the limits of measurement quoted by him. The nests seem by me, eleven in all, were found between the 16th and 25th April, and I do not know if the birds breed again in July, as they do near Rangoon.

23. The White-winged Jay—*Platysmurus leucopterus.*

On March 12 I was fortunate enough to find a nest of this species containing four eggs, quite fresh, with the exception of one which showed slight blood streaks, thereby indicating that the clutch was complete and that incubation had commenced. The nest was exactly as described by Davison, forty years ago, placed on the frond of a cane, (Oates, who was not a botanist, has incorrectly translated "Calamus" as "reed" in his note on the breeding of this bird). The nest found by me was placed at a height of about ten feet from the ground, and exactly resembled a rather large crow's nest from below, being entirely composed of small sticks. The cup was deep, neatly lined with roots, and well rounded, it contained a few fresh flowers of an epiphytic creeper, a *Vaccinium* I think. The eggs measure, in inches, 1·30×0·94, 1·28×0·92, 1·29×0·96, and 1·27×0·95. They are very heavily speckled all over, more densely at the large end, and very closely resemble those of *Cissa chinensis ;* in fact, except that they are a trifle longer and broader, and have a rather greenish tint, they are difficult to distinguish from those of the Green Magpie. There is not, however, the slightest doubt as to their authenticity, as I myself saw the old bird sitting on the nest, and she did not take flight until we were within a couple of yards of the nest, and subsequently hung about protesting vigorously against the robbery. A Karen who was with me on this occasion, later found another nest with two fresh eggs which he brought to me ; this was in all respects similar to the one found by me, but the eggs, as is so common with Jays, were by no means identical, being larger, lighter in colour, and more pointed. These two eggs measure 1·42×0·97 and 1·35×0·93 and are undoubtedly genuine as the finder was able to name the bird, (it is called Tokluh in the Karen language), and also picked out the bird, without assistance, from my collection of skins.

64. Black-throated Laughing Thrush—*Dryonastes chinensis.*

I have only met with this bird once, and this was at an elevation of about 3,000 feet on Nwalabo, in heavy bamboo forest. The nest was small, no larger than that of *D. sannio*, made of bamboo leaves and thickly lined with coarse roots. It was placed in a banboo fork, about seven feet from the ground, and contained three fresh eggs, of the palest possible skimmilk blue, narrow and pointed and measuring 1·23×0·90 : 1·23×0·88 : 1·25×0·86.

86. Chestnut-headed Laughing Thrush—*Trochalopterum melanostigma.*

These birds are not uncommon in the dense evergreen on the slopes of Nwalabo, at an elevation of about 2,000 to 3,000 feet. I found my first nest on May 11, 1918, with two fresh eggs in a small sapling. It was a massive cup of green moss, lined with the black hair-like fungus so commonly used for this purpose. Parenthetically I may remark that this appears to be the substance referred to by writers on oology as " fine black roots", " hair-like roots," etc., etc. It is, as a matter fact, a thread fungus which attacks the leaves of trees and other plants ; I have found a piece of this substance, fully three feet in length, coiled round and round and used by a bulbul as a lining for its nest. To return to the *Trochalopterum*, the nest was placed on, and built into, the moss in a fork of a small branch and one egg unfortunately was broken in getting it down ; the other measures 1·20 × 0·85 and was, when fresh, a beautiful sky blue, (it has since faded), marked with some large blotches of sepiaat the large end, and a few spots of the same colour scattered over the rest of the surface. In 1918 I also found two other similar nests, but they were empty and had apparently been used. In 1919 I visited Nwalabo again, and on April 25 found a nest in process of construction, watching the birds for some time. This nest however, was not in the least like that described above, as it was built in a tangle of creepers and was composed entirely of dry leaves, not a scrap of green moss being used, although this material was readily available. This nest was for some reason deserted, and a new one was commenced a few yards away, this time on the frond of a tree fern ; on May 10 a friend went to take the eggs for me, but though the bird was seen on the nest, there were no eggs, and I presume she deserted again, as I never got the eggs. A third nest, with two fresh eggs, was found on April 30, this time in a hanging bamboo, and was in all respects similar to that of *Dryonastes chinensis*, for which I mistook it till the parent birds put in an appearance. The evidence at present available thus goes to show that *T. melanostigma* is very irregular in its choice of nesting site and material and is only constant in always selecting a deep moist ravine in which to build its nest. The two eggs taken this year differ in no way from the one described above.

118. Tenasserim Scimitar Babbler—*Pomatorhinus olivaceus.*

Common and noisy in bamboo forest. A very neat nest, with three fresh eggs was found near the head waters of the Tavoy river, on March 7. It was placed in a large crevice between the roots of a tree, and was composed externally of bamboo leaves, and neatly lined with fine grass, but although so tidily built and apparently compact it fell to pieces when removed. The nest was of course domed, and both it and the eggs were in all respects typical.

160. Abbott's Babbler—*Turdinus abbotti.*

Was found breeding commonly in the heavy evergreen at the end of February and beginning of March. The full clutch appears to be three, but sometimes only two are laid. Nests and eggs precisely as described by Hume, but the latter are subject to a good deal of colour variation *inter se.*

175. Red-winged Babbler—*Cyanoderma erythropterum.*

The nest much resembles that of *Mixornis*, but is more massive, loosely made of bamboo leaves, and neatly rounded and lined with fine grass inside. It was placed in a small cane plant near the ground and contained two incubated eggs on April 16. These eggs differ from those taken by Stuart Baker's collectors in that they are unspotted, and of a white colour, very faintly tinged with blue. They measure 0·66 × 0·50. The bird was seen to leave the nest by Mackenzie and myself, and was shot by me in his presence on its return, so there can be no doubt as to the correctness of the identification of the eggs, which appear, however, to be abnormal in colouration.

177. Sumatran Yellow-breasted Babbler—*Mixornis gularis.*

The nest and eggs of this bird, which is of course nothing but a geographical race of *M. rubricapillus*, as might be expected exactly resemble those of the latter species. A nest with two fresh eggs was brought to me in Mergui on April 27, 1918, together with the parent bird (alive), which had been snared on the nest.

218. Tickell's Staphidia—*Staphidia striata.*

Common on Nwalabo at an elevation of about 3,000 feet, where it breeds freely in holes in road cuttings. Numerous nests were found during the first week in May 1918, but with the exception of one nest these were empty, and some showed signs of having been occupied by young birds. It is probably a fairly early breeder, as at the end of April 1919 I found a lot of nests with fresh eggs, or rather egg-shells, as in every case the eggs had been sucked, I suspect by tree-shrews, which are exceedingly common. The nests are made of moss and lined with bast fibres, and except for the fact that they are cup-shaped, they rather recall the nest of a mouse.

298. Yellow-vented Bulbul—*Pyononotus analis.*

An inhabitant of low-lying swampy country, from Mergui southwards. The nest is of the ordinary bulbul type and is built generally in a fairly thick bush often near the ground ; two nests were placed in creepers which had enveloped dhani palms (*Nipa fruticans*), whilst one was practically on the ground in a grass tussock. I have had no luck with this bird, as the nests were almost all empty or else occupied by newly hatched young, and very few eggs were obtained. These are of a very red appearance, due to the rich, almost blood, red spots with which they are thickly speckled all over, though Darling, whilst noting this type of colouration, observed that the eggs of this species were prone to the usual amount of variation met with in the eggs of most bulbuls. The birds breed here in March and April, and very possibly earlier ; the eggs taken average about 0·85 × 0·65.

299. Finlayson's Stripe-throated Bulbul—*Pycnonotus finlaysoni.*

Although the bird is so common, nests are rather scarce. It seems to like fairly open country for breeding purposes, and the nest as a rule is placed in an isolated shrub, within two or three feet from the ground: when one does come across a nest it is easy enough to see. The birds seem to lay invariably two eggs, at all events I have no record of a greater number, though I have a vague idea that Mackenzie once found one with three. The description given by Hume does, as usual, full justice to these pretty eggs, and I have only to add that the type with the well marked zone of blotches is a very shrike-like egg. Those in my collection measure on the average about 0·82 × 0·62.

310. Black-headed Bulbul—*Micropus melanocephalus.*

A nest was found on March 6 with two young about two days old. It was on a frond of a cane, in dense evergreen forest, and was more like a flycatcher's nest than a bulbul's, being a tiny pad of dead leaves, the very shallow cup being sparsely lined with the hair-like fungus. The parent birds hawked insects on the wing, much after the manner of flycatchers, with which they fed their young.

329. Tenasserim Ashy Drongo—*Dicrurus nigrescens.*

Two nests were found by me in scrub jungle on the sea coast on April 14 1919. The first of these was avery shallow pad of the usual drongo type, placed on the top of a horizontal fork of a branch about seven feet from the ground, and contained three fresh eggs with a pink ground colour and spotted all over, very much recalling certain types of nightjar's eggs ; the second nest was in the vertical fork of a small pollard, tree, a deep cup, and as conspicuous as a bulbul's, and the eggs, two in number and fresh, had a pure white ground colour and were richly marked with deep brownish red blotches, and it would be hard to imagine any two types more dissimilar.

543. Gold-crest Myna—*Ampeliceps coronatus.*

A nest was found in process of construction in a hole in a casuarina tree at a height of about thirty feet from the ground, on April 14, and I got the clutch of three fresh eggs on April 30. The nest was said to consist of dead leaves and casuarina shoots, whilst the eggs are a clear Cambridge blue, and measure 1·12 × 0·78 : 1·01 × 0·78: 0·97 × 0·80.

731. White-bellied Munia—*Uroloncha leucogastra.*

These birds, which are found as far north as Tavoy, appear to replace *U. punctulata* south of Mergui. The nests are precisely like those of *U. punctulata,* and the birds breed throughout the year, but chiefly in the hot weather. They lay five or sometimes six eggs ,which average about 0·58 × 0·44.

898. Burmese Yellow-breasted Sunbird—*Arachnechthra flammaxillaris.*

This beautiful little sunbird nests from December to March, making the usual sunbird's nest, often in gardens and close to houses. It is fond of such trees as limes and guavas for building upon, or a prickly bush may be chosen. The eggs, which seem to be always two in number, somewhat resemble those of *A. asiatica,* but are as a rule of a decidedly more greenish ground colour.

905. Plain-coloured Sunbird—*Anthothreptes simplex.*

I record this, subject to correct identification of the female, which was shot off the nest. This was found on March 17, 1918, in scrub near the sea, and was made of grass, and very thickly felted inside with soft silky pappus probably from a *Calotropis,* or some similar plant. It was suspended like a sunbird's nest and had a similar portico, but otherwise in general appearance rather resembles a Munia's nest. The eggs are very pale lilac, with purplish clouds at the large end, and a very few deep purple (almost black), splashes and scriggles elsewhere on the eggs, in one of which the markings are mostly at the small end: the eggs measure 0·74 × 0·50: 0·72 × 0·50.

939. Dusky Broadbill—*Corydon sumatranus.*

On the same day on which I found the *Platysmurus*' nest, and not very far from it, whilst following the course of the stream through heavy evergreen forest, my attention was attracted by an enormous mass of moss and debris suspended from the tip of a cane. I could not at first believe that this was the nest of a bird, but investigation revealed the unmistakable entrance hole, and a little shaking of a convenient creeper caused the bird to take flight Making sure from the closeness with which it sat that the nest contained eggs, at considerable trouble we got down the nest intact from a height of about forty feet, when to my great disgust I found that it contained four newly hatched young. It was seven feet in length, and must have weighed fully ten pounds, and was composed of coarse dry moss, to which all sorts of odds and ends, pieces of sticks, leaves, cocoons, and so on had been added. The entrance hole and the nest cavity were placed about the middle of the mass, all of which had undoubtedly been placed in position by the birds, and it would be interesting to know how long a time was occupied in building the nest, whether it represented the accumulation of several years. We replaced the nest as far as possible in its orignal position, but I was unable to visit the spot again.

940. Black and Red Broadbill.—*Cymborhynchus macrorhynchus.*

The nests of this species are simply smaller editions of that just described, but are none the less very large untidy-looking structures. They are built as a rule on an isolated tree either in a swampy open space, or if in the forest, on the bank of a stream or where there is an open patch, and never far from water. They are always suspended from the tip of a branch, sometimes at a considerable height from the ground. Last year we were very unlucky, as although Mackenzie and I found numerous nests in April, nearly all were empty. Probably the birds are early breeders, as this year I have taken two nests with eggs during the first week in March. All the eggs taken are of the cream or fawn coloured type, very heavily speckled all over with amber brown, and average about 1·05 × 0·75. The nests are, after the usual Broadbill fashion, lined with green leaves, which are not however renewed as incubation proceeds; the normal clutch appears to be three.

942. Gould's Broadbill—*Serilophus lunatus.*

On March 12, truly a red letter day, I found no less than seven nests of this bird, all suspended from bushes in or near the same stream where the *Platysmurus* and *Corydon* nests were found. These nests are made of green moss and are much more neatly and tidily built than are those of *Cymborhynchus.* In size, too, they are not exaggerated, and are more or less spherical, with a diameter of about six inches. The full clutch appears to be five, but at times only four are laid, and they never seem to vary in type, all that I have found here and elsewhere having a white ground colour, and being profusely speckled with purplish brown.

944. Long-tailed Broadbill—*Psarisomus dalhousiæ.*

These birds appear to be confined to Nwalabo at a height of about 2,000 to 3,000 feet, where several nests were found in April and May.

945. Green Broadbill—*Calyptomena viridis.*

On March 7 I shot a male of this species, and subsequently found an unfinished nest close by the spot: and on the same date my Burman found two nests, one empty, the other with a single young bird. He was much struck by the antics of the parent, which appears to have put up a regular lapwing stunt in its endeavours to entice him away from the nest. Unlike other broadbills, this bird builds in thick jungle, away from water, and the nests are composed, not of moss, but of grass and fibres, and those found were in all respects similar to those described by Hume, being built across, and not from the tip of twigs, pinched flat at the point of suspension, and provided with a long hanging tail. I showed a nest and my specimen to one of my Rangers, and a fortnight later he brought me in a precisely similar nest with three incubated eggs, which were long and rather pointed, of a creamy colour, and unspotted.

984. Malay Rufous Woodpecker—*Micropternus brachyurus.*

There seems to be very little cause for separating this bird from *M. phæoceps* of which it is little more than a local variety. The breeding habits of both are, as might be anticipated, identical; two nests were taken on February 22 and March 4, and contained respectively two and three fresh eggs; they were made in tree ants' nests, and these in turn were built on bamboos. The eggs are indistinguishable from those of the northern species.

1032. Red-bearded Bee-eater—*Nyctiornis amictus.*

On April 27th 1918 I found a nest in a hole in a bank about twenty miles south of Mergui, which contained two newly hatched young, and an egg on the point of hatching. This year on April 4 I found a nest with two eggs already chipped, and which were preserved with much difficulty. They seem very large as they measure 1·34×1·10 and 1·30×1·12. The nest holes though in soft sand were neither more than three feet long, and the eggs rested on a mass of wings of some hymenopterous insect, probably a hornet.

1055. Blyth's Wreathed Hornbill—*Rhytidocros subruficollis.*

I have never actually seen a nest myself, but one of my Rangers succeeded in finding three, and brought in the eggs and the parent birds alive: the dates were March 3, 1918, two eggs hard set; March 11, 1918, two eggs nearly fresh; and February 15, 1919, three eggs fresh. All three are described as being of the typical Hornbill type, placed in holes of large trees at a great height from the ground, and with the entrance plastered up in the usual manner; the old bird was in each case in good condition and had no difficulty in flying when released.

Near Lawthaing, at the headwaters of the Tavoy river, immense numbers of *R. undulatus* and *R. subruficollis* congregate every evening for the purpose of roosting, curiously enough selecting bamboos and not trees; I have counted as many as two hundred which had already arrived, and small flocks of six to a dozen were still coming in at dusk; this was in February.

1083. Hume's Swiftlet—*Collocalia innominata.*

1084. Little Grey-rumped Swiftlet.—*Collocalia francica.*

These two species breed in company in large numbers on the Mali Islands, a few miles from the coast, about half-way between Tavoy and Mergui. *C. francica* makes the edible nests of commerce, which are a

Government monopoly, the right to collect them being sold by auction, but the nests of *C. innominata,* though of very little value on account of the large amount of grass and feathers used in their construction, are also collected by the licensee, but are only purchased by the poorer classes. The pure white nests of *C. francica* are worth, at present prices, about Rs. 140 a viss ; those of *C. innominata* being worth only about Rs. 5.

C. innominata is the earlier breeder of the two, commencing nesting operations in February, a few eggs being laid about the first week in March ; but *C. francica* does not lay till well on in April, and fresh eggs may be taken as late as the latter half of May, by which time *C. innominata* have all hatched off ; and whilst this latter species plasters its nests at random on the walls of the caves anywhere above high-water mark, *C. francica* always goes to the top of the cave, and places its nests well inside a fissure of the rock. The eggs of *C. innominata* are constantly the larger, measuring on the average 0·94 × 0·62, whilst those of *C. francica* average 0·83 × 0·52. A very long egg of *francica* may be as long as a very short egg of *innominata,* but is always narrower, and the eggs of the two species can be distinguished with certainty.

A difference in the habits of the two is that whilst *francica* leaves the caves at dawn, finds its food over the mainland, and returns to the islands at dusk, *innominata* haunts the caves all day, and the numbers are so great as to recall white ants fluttering round a lamp, and the birds may even be caught by a quick grab of the hand, a feat which we actually saw performed several times.

1103. Yellow-breasted Trogon—*Harpactes orescius.*

Although none too often seen at their times, one discovers in the breeding season that this is one of the commonest birds, and I must have seen some twenty-five or thirty nests. Once one gets the hang of it, they are very easy to find, all that is necessary being to examine every stump that looks sufficiently rotten for the trogon to be able to peck. They lay from the middle of February to the middle of March, and the nest is placed at any height from three to fifteen feet from the ground. As a rule the bird scoops out a hollow about the shape and size of a cocoanut, with the top quarter cut off diagonally, and in this it sits facing outwards with its long tail raised vertically and pressed against the back of the hollow. Normally the clutch is only two, but very occasionally three eggs are laid ; they are cream coloured and of course unspotted. The nests are very frequently placed close to a path : *c. f.* Bingham's notes in Hume's Nests and Eggs.

1314. Little Malay Cuckoo-dove—*Macropygia ruficeps.*

Appears to be very rare and confined to Nwalabo mountain. A nest of the usual dove type, with a single fresh egg was found on May 14, 1918.

1551. Lesser Adjutant—*Leptoptilus javanicus.*

These birds breed in several spots on the little Tenasserim river, the largest colony, consisting of about forty nests, being at Indaw village, some sixty miles south of Mergui. I first found this on December 23, 1917 ; but on that date all had hatched out ; and I only got one addled egg. In 1918 I was unable to reach the spot before November 23 which proved rather late as most of the broods had just hatched, but I got seventeen eggs, all with the exception of one clutch very hard set. The nests are built in Kanyin (*Dipterocarpus*) trees at an immense height, fully 150 feet, and are only accessible to professional climbers, who drive previously prepared bamboo spikes into the trunk, forming a ladder as they climb. The full clutch is four, but as often as not only three eggs are laid.

CYRIL HOPWOOD, M.B.O.U.

No. XXIII.—MESOPOTAMIAN BIRD NOTES.

The publication by Mr. W. D. Cumming of corrigenda to the Lists of Birds from Fao published in the *Ibis* for 1886 and 1891, is welcome, although somewhat belated. As there are at the present time several active workers in Mesopotamia who are interested in the subject, may I be allowed to offer a few remarks on Mr. Cumming's paper.

Upcher's Warbler (*Hypolais languida*). Mr. Cumming describes this species as plentiful, breeding everywhere on both sides of the river, and adds that the note in the *Ibis* 1891, p. 109, under the heading of *Scotocerca inquieta* refers rightly to this bird. The Bombay Natural History Society's little pamphlet compiled by Mr. N. B. Kinnear only mentions two species of *Hypolais, H. languida* and *H. rama*. It is true that Mr. Cumming sent home two skins of *H. languida* from Fao, obtained on August 27th and 28th (*Ibis* 1891, p. 108) and that the range of this species extends from Palestine to Persia. There is however no evidence at present that this species breeds near Fao, or in the plains of Mesopotamia. The eggs sent by Mr. Cumming, and which were described by Sharpe (*t.c.* p. 109) as those of *Scotocerca inquieta* (!) were really those of *Hypolais pallida pallida*, a species which is not mentioned either by Sharpe or Kinnear. This bird breeds commonly at Fao and in Mesopotamia. Probably *H. languida* occurs as a breeding species in the hilly districts, such as the Zagros, whence Sarudy records it as nesting and on passage, while *H. p. pallida* is common and generally distributed on the plains and also in the Zagros.

Finsch's Grey Shrike (*Lanius fallax*). "I believe this was wrongly indentified and corrected later to *L. assimilis* by Dr. Bowdler Sharpe." A case of making confusion worse confounded! Two races of Great Grey Shrike appear to occur in Mesopotamia in winter, the Palestine Grey Shrike (*Lanius excubitor aucheri*), which is frequently but erroneously called *L. fallax* and breeds in the Zagros district, Syria, etc., possibly also in the Mesopotamian plain, and secondly the closely allied Transcaspian Grey Shrike (*L. excubitor pallidirostus*) which occurs on passage and in winter.

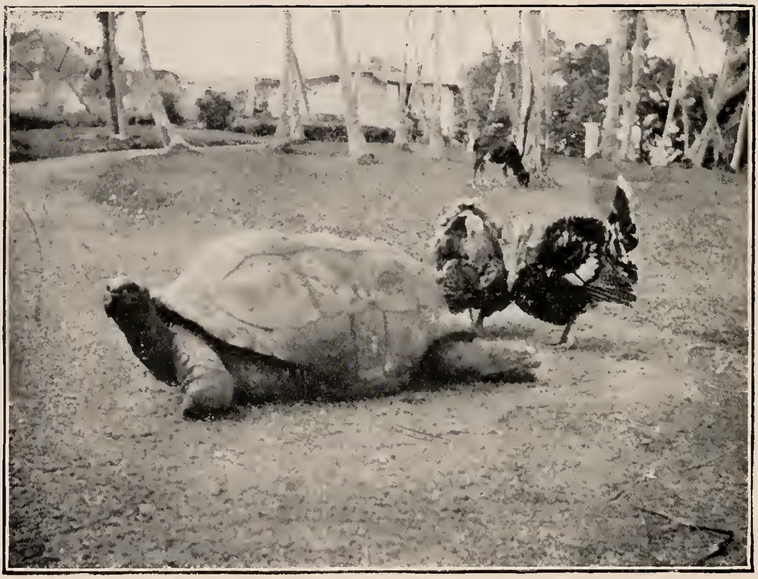
Cumming's Red-rumped Wheatear (*S. cummingi*). "I believe I identified this as *S. chrysopygia* but Dr. Bowdler Sharpe found it to be a new species and named it after me." This statement is incorrect in several particulars. In Dr. Sharpe's list (*Ibis* 1886, p. 483) it figures as *Saxicola moesta*! It remained under this name till Mr. J. I. S. Whitaker described it as a new species under the name of *Saxicola cummingi* some fifteen years later. *Cf. Bull, B.O.C.*X., p. xvii; *Ibis* 1902, p. 58 and pl. III. It is now generally agreed that there is only one species of Red-rumped Chat, *Œnanthe xanthoprymma* (H. & E.), which is divisible into two (or possibly three) local races.

(1) *Œnanthe xanthoprymma xanthoprymma* (H. & E.). Hitherto only recorded by British ornithologists from Egypt, Nubia and the Red-sea littoral. Probably breeds in Arabia and according to Sarudy in the Zagros.

(2) *Œ. xanthoprymma chrysopygia* (De Fil.). This race breeds in Southern Transcaspia, Persia and Persian Baluchistan.

(3) *Œ. xanthoprymma cummingi* (Whit.). Only differs from the typical form in having the bases of the tail feathers the same red brown as the rump, instead of white. It has been obtained at Fao and also from Berber in winter, while Sarudy states that it breeds in the hills which bound the plain of the lower Karun River and is common on spring passage on Djebel Tnüë. He adds that "*S. xanthoprymna*" according to the Arabs breeds on the same ground and that the two birds may be found mated together. If there is any truth in this statement, *Œ. x. cummingi* can only be an individual variation.

Journ., Bombay Nat. Hist. Soc.



GIANT TORTOISE (TESTUDO GIGANTEA) AT HIRUMBARD, GALLE.

"Indian Roller." *Coracias garrula* [*Sic.*] Apparently both the European Roller (*C. garrulus*) and the Indian Roller (*C. indicus,* or more correctly *C. benghalensis*) breed in Mesopotamia, but the latter species appears to be prevalent south of Bagdad, though the European Roller seems to be the representative species at Bagdad according to Sassi. I have long been puzzled by Mr. Cumming's notes on the Rollers in the *Ibis* 1886, p. 488, and in the light of the later communication can only suppose that by some mistake the notes on the two species have been transposed.

With regard to the small Bustard shot on two occasions by Mr. Cumming, but not preserved, if noticeably smaller than *Houbara u. macqueeni,* it was in all probability the Little Bustard, *Otis tetrax,* which is known to occur both in Mesopotamia and the Zagros. The Eastern Pintail Sandgrouse (*P. alchata caudacuta*) breeds in large numbers both in the Tigris and Euphrates valleys as well as near Ahwaz.

F. C. R. JOURDAIN.

Appleton Rectory, Abingdon, Berkshire,
14*th February* 1919.

No. XXIV.—THE GIANT TORTOISE LIVING IN CEYLON.

(*With a plate.*)

Through the kindness of Mr. W. Ormiston of Kalupandani, Huldummulle, Ceylon, we are able to reproduce a photograph of a giant tortoise, living at Hirumbard near Galle and which appears to be the same animal Mr. J. Pearson of the Colombo Museum, wrote about in *Spolia Zeylanica* Vol. VII, p. 209, 1911. According to that note, this tortoise belongs to the kind known as *Testudo gigantea,* a species which was formerly indigenous, to the Seychelles, but the history of how this particular one came to Ceylon and how long it has been there is obscure. It appears to have been at Galle since 1846 and Mr. Paul Pieris, C.C.S., wrote to Mr. Pearson that some years ago he was shown by a relation of his some papers, which were said to prove that the tortoise was 120 years old.

As a matter of fact that is not a very great age for one of these giant tortoises and quite recently the home papers reported the death of the old tortoise at the Zoo, which is stated to have been 260 years old. In Lord Rothschild's museum at Tring there is the shell of an example of *T. gigantea,* which measures 46′-5″ in length and belonged to an animal weighing 593 lbs., said to have been 300 years old when it died.

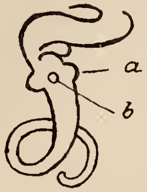
These large tortoises formerly inhabited the Galapagos islands, Madagascar, Aldabare, the Seychelles, &c., but for many years have been extinct in their native haunts, except were especially protected. Some of the islands on which they were indigenous were uninhabited by men, but with the advent of sailing ships from the west the tortoises were doomed, as captains of merchantmen found in them a useful food, which could easily be kept alive and so provide fresh meat for the crews, who in these days were mostly fed on salt junk. The history of these interesting animals has been written both by Dr. Gunther and Lord Rothschild, and Dr. Gadow in the volume on "Reptilia" in the Cambridge Natural History gives a short summary of what is known about them. In the Swalik hills in the Punjab the remains of a gigantic tortoise have been found, this animal lived probably in the early Pliocene times and was considerably larger than any of the recent giant tortoises.

N. B. KINNEAR.

Bombay Natural History Society,
July 1919.

No. XXV.—THE RUDIMENTARY HIND LIMB IN AN EMBRYO OF *PYTHON MOLURUS*.

In Volume XXV of this Journal (page 509) Mr. D'Abreu has contributed a particularly interesting note on the breeding of *Python molurus* in captivity. Among other interesting observations he records the existence of two minute prominences—the rudiments of the hind limb —in a young embryo about three inches long.



(a) Rudimentary hind limb
represented by a bud—
(b) Opening of cloaca

I wrote to him on the subject, and suggested that the prominences referred to might prove to be the rudiments of the male clasper, and not the rudiments of a limb. In reply he has very courteously sent me the specimen to examine, and I am pleased to be able to confirm his observation, and have made a drawing of the condition. The opening of the cloaca is seen as a circular orifice. On either side, and on the lateral surface of body, low down, is a bud-like projection. When the embryo is viewed in profile this bud is seen to be oval shaped, and obliquely placed, the largest diameter passing backwards and downwards. I could discern nothing to suggest rudiments of an anterior limb.

F. WALL, LIEUT.-COL., I.M.S.

BANGALORE, 16*th April* 1919.

No. XXVI.—THE HABITS OF THE GREEN WHIP SNAKE *DRYOPHIS MYCTERIZANS*.

With reference to the note on "The Habits of *Dryophis mycterizans*" published in the Journal—Vol. XXVI, No. 2, p. 681—, may I inform Mr. A. M. Kinloch that I have come to look upon *D. mycterizans* "eating" other snakes as quite a common occurrence? Among the victims I may mention *Helicops schistosus, Tropidonotus pitcator, T. platyceps, Polyodontophis collaris.* In all these cases the victim's head was well in the mouth of the aggressor and was kept there from two to five minutes before being released. I always examined the victim as soon as set free and never noticed any tooth marking on the head, nor was there any appreciable quantity of saliva about it. The last case on record occurred recently, in March 1919, the victim being another *D. mycterizans* whose head was well down the throat of the aggressor at the time of my arrival on the spot. The victim's head was disgorged three minutes after and was found to show no tooth puncture; it was, however, covered with saliva, a sign that deglutition had begun. Both the aggressor and its victim are still in my serpentarium living together in perfect harmony, with a rather mixed crowd of other snakes.

One of my colleagues here tells me that cases are known of a *D. mycterizans* kept in captivity in our College Museum fully eating a specimen larger than itself. Major Wall—Journal Bombay Natural History Society, Vol. XVI, No 4, p. 547—reports a case of cannibalism practised by this snake, the victim being *Tropidonotus stolatus*, as mentioned by Mr. Primrose—Bombay Natural History Journal, Vol. XV, p. 347.

J. F. CAINS, S.J.

ST. JOSEPH'S COLLEGE, TRICHINOPOLY.
11*th June* 1919.

No. XXVII.—NOTE ON THE SNAKE *TRIRHINOPHOLIS NUCHALIS* (BOULENGER).

A small decapitated specimen of this little known snake has been acquired from Mr. Leonard from Sima, Upper Burma. Longitude 97°, Latitude 25°, Altitude 4,400 feet.

The type was described in 1893 by Boulenger in his Catalogue Vol. I, p. 419, and figured in Plate XXVIII of the same Volume, from a specimen captured at Tounggyi in the S. Shan States. A second specimen referred to me for identification by our Secretary some time back was obtained at Mansi, Upper Burma, at almost the same longitude and latitude as Mr. Leonard's specimen. In the Mansi specimen the ventrals are 139 and subcaudals 23. The anal entire as in the type. The scales are 15 in the whole body length.

Mr. Leonard's specimen measuring 5⅞ inches, the tail accounting for half an inch, also agrees well with the type. The ventrals are 136 ?, subcaudals 25, anal entire, and scales 15 in whole body length. I notice that Macolm Smith refers to this in his list of Siamese snakes as occurring north of the Isthmus of Kra and he records two specimens from Province Ratchaburi, Siam (near the Tenasserim border). The ventrals and subcaudals were 141+24, and ♂ 132+24 respectively.

F. WALL, LT.-COL., I.M.S.

BANGALORE, 2*nd June* 1919.

No. XXVIII.—A GRAVID SPECIMEN OF THE SNAKE *CYLINDROPHIS MACULATUS* (LINN.).

Among a few snakes sent to me last year from Ceylon by Mr. Gerard Joseph, was a specimen of *Cylindrophis maculatus*, which proved to be gravid. The date of its capture is unfortunately not on record.

The parent measured 10¾ inches, and when cut open was found to contain two large fœtuses, one ♂ with the genitalia protruding, and the other a ♀. Each was folded into three. The united measurements of the two almost equalled that of the prospective mother; the ♂ taping 5, and the ♀ 5⅜ inches. From this it is evident that the embryos acquire an usual degree of development before birth, and that the species is not prolific. The young were coloured and marked exactly like the parent.

The viviperous habit of this species is not a new observation since Abercromby (*Spolia Zeylanica*, Vol. IX, p. 146) in 1913 recorded a specimen with three well developed fœtuses " in abdomina". This was acquired by him on 1st April. No measurements of the dam or young were given.

F. WALL, LT.-COL., I.M.S.

BANGALORE.

No. XXIX.—REPLY TO DR. MALCOLM SMITH'S REMARKS IN THE LAST JOURNAL.

In answer to Dr. Malcolm Smith's criticism in the last Journal (p. 682) on my identification of his specimens sent from Siam, which I considered to be *Hydrophis cyanocinctus* (Daudin) (*vide* Bombay Natural History Journal Vol. XXV, p. 754), I would like to make the following reply.

My conception of *Hydrophis cyanocinctus* is based upon well over one hundred specimens collected from an extensive area, *viz.*, Persian Gulf, Coast of Sind, W. Coast of India especially Bombay and Cannanore, the Coast of Ceylon, the E. Coast of India especially Madras, Orissa, and the Sunderbunds, Chittagong, and the Coasts of Burma and Tenasserim. In addition I have examined all the sea-snakes, in the British Museum, upon which the descriptions in Boulenger's Catalogue are based. (Vol. III, 1896.) The specimens described by Dr. Malcolm Smith as *H. siamensis* (Journal Natural History Society, Siam, Vol. II, 1917, p. 341), which I consider *H. cyanocinctus* are all from a small area, *viz*, the Coast of Siam. The differences he claims for his *siamensis* as opposed to *cyanocinctus* (Daudin) I will deal with in detail.

For easy reference I append in column A my range of costals and ventrals for what I consider *cyanocinctus.* In column B are those given by Dr. Malcolm Smith for his *siamensis.*

A. *cyanocinctus.*	B. *siamensis.*
(1) Costals two heads lengths behind head 25 to 36.	(1) neck 29 to 35.
(2) Costals at midbody 33 to 44.	(2) maximum girth 35 to 42.
(3) Ventrals 280 to 397.	(3) 271 to 343.

It will be noticed that Dr. Malcolm Smith's figures are completely contained within mine.

(2) *The frontal.* Dr. Malcolm Smith places reliance on the frontal shields, but I find that the length of the frontal, and the length of the snout vary a good deal in individuals of the same species.

(3) *Temporals.* With regard to the temporals, by Dr. Malcolm Smith's own showing, these are aberrant in 33 per cent. of his specimens! It is difficult to see therefore how he can place any reliance on these shields in establishing his *siamensis* as a species.

(4) *Dentition.* Dr. Malcolm Smith remarks that in one place I have noted the posterior maxillary teeth of *cyanocinctus* as 6 to 8, and that in his specimens from Siam I count them 8 to 9, doubtfully 10. As my skull collection enlarges I frequently have to modify previously expressed views, and a slight increase of previously reported figures is to be expected. In 10 specimens of *cyanocinctus* in the Indian Museum I found the variation 6 to 10. In at least 12 others they range again from 6 to 10.

(5) *Length.* Dr. Malcolm Smith says his Siam specimens do not exceed 1,000 mm., whereas *cyanocinctus* grows to 1885 mm., and he seems to think that the fact that seven of his specimens were gravid clinches the matter of length. However it is very well known that snakes grow considerably after attaining sexual maturity. My breeding notes on many species abundantly illustrate this. As an example let us refer to Mr. D'Abreu's note in this Journal on the breeding of *Python molurus* (Vol. XXV, p. 509). Here the lengths of the parents are noted as ♀ 8 feet 6 inches, and ♂ 5 feet 8 inches. It would not be sound to argue from this that a snake 5 feet 8 inches long, and sexually mature should be considered of a different species from one that well authenticated records show reaches over 19 feet.

(6) *Colouration.* This is so variable that it carries little if any weight in establishing many species, and I find *cyanocinctus* from Indian Coasts remarkably variable.

Dr. Malcolm Smith may be perfectly correct in his view that the species he has described as *H. siamensis* is valid, but I think it rests on a very insecure basis, and is not supported by the facts I have explained above.

F. WALL, LIEUT.-COLONEL, I.M.S.

BANGALORE, 21*st July* 1919.

No. XXX.—NOTES ON SOME RECENT ADDITIONS TO OUR SOCIETY'S SNAKE COLLECTION.

On my return to India this year I was shown, while passing through Bombay, a number of interesting snakes, which had been received by the Society during the last few years. These had already been indentified by Mr. Prater and two were recorded by him in the previous number of the Journal, but nevertheless I have included them in these notes as I have been able to add some additional information.

TYPHLOPS JERDONI (BOULENGER) (= TYPHLOPS DIVERSICEPS (ANNANDALE)

A well preserved specimen of this little known, and seemingly rare snake, was presented to the Society's collection by Mr. J. M. D. Mackenzie from Pegu. As all the other known specimens are from Hills, it would be interesting to have further information concerning the exact locality in Pegu (District ?). The specimen accords well with Boulenger's description (Faun. Brit. Ind. 1890, p. 238), except in the following points :—

The rostral is more than one-fourth, but less than one-third the breadth of the head at the eyes. The nasals shields just meet behind the rostral. The præocular touches the 3rd labial only. The diameter of the body is about $\frac{1}{35}$ the total length, the latter being $5\frac{1}{2}$ inches. In a later description of the snake, Boulenger modifies his original observations, in a corrigendum (Cat. Snakes, Brit. Mus. Vol. I, 1893, p. 418) showing that the præocular touches only the third labial, and it may be remarked that this is the only Indian species of the genus that shows this peculiarity.

In 1891, Sclater (List. Snakes, Ind. Mus., p 2) reported a specimen from Buxa Doors. Among collections of snakes belonging to the Indian Museum, and submitted to me at various times by Dr. Annandale for identification, I was able to examine, and confirm the identification of Sclater's specimen. I found another labelled Lashio. N. Shan States. The examination of Annandale's type of *T. diversiceps* from Pashighat, Abor Hill (Rec. Ind. Mus. Vol. VIII, p. 44 and plate I) shows that the specimen is a very typical one of *T. jerdoni.* The scale rows reported as 18 are in reality 22. The anterior nasal touches the first and second labials, not the first only as reported. The præocular touches the 3rd labial only. The diameter of the body is about $\frac{1}{65}$ the total length. In this Journal (Vol. XIX, p. 338), I reported a specimen from the Darjeeling neighbourhood (Pashok or Tindharia) $9\frac{1}{4}$ inches long.

The habitat at present known for the species is Eastern Himalayas, Hills of Assam, Burma as far East as the N. Shan States.

COLUBER (ABLABES) PAVO (ANNANDALE).

A very nice little specimen of this rare snake described in 1912 by Dr. Annandale (Rec. Ind. Mus. 1912, Vol. VIII, p. 47, and plate) from a single specimen captured in the Abor Hills has recently enriched the Societys' collection. This was found at Kindat on the East bank of the Chindwin River, Upper Burma, and therefore considerably extends the habitat. This specimen differs from the type in having the scale rows 21 two headslengths behind the head, 21 in midbody, and 17 two headslengths before the vent. The ventrals are 225, and the subcaudals 75. The tail is possibly very slightly deficient. The supralabials are 8, the 4th and 5th touching the eye on the left side, in this specimen. The left side agrees with the type. The posterior extension of the post-nasal so well shown in Dr. Annandale's figure, suggesting a confluence of this shield with the loreal, is again exactly repeated in the Burmese specimen.

I find the maxillary teeth 17 (possibly 18) on the left side very gradually and slightly decreasing posteriorly. The mandibular teeth are enlarged anteriorly. On these dental characters the species would appear to have better claims to inclusion under *Coluber* than *Ablabes.* On superficial characters too it appears to me to have closer affinities to *C. porphyraceus* than any *Ablabes.* The ventrals are too numerous for *Ablabes,* and accord with *Coluber,* and the scale rows accord with *Coluber* rather than *Ablabes.*

CALAMARIA PAVIMENTATA (D. & B.).

A nice little specimen of this uncommon snake was received from Mrs. Jackson, from Tura in the Garo Hills, Assam. The previously known habitat (China, Cochin, China, Siam, Java, Burma) is thus considerably extended.

The lepidosis is very typical. A præocular is present. Ventrals number 200, and subcaudals 16. The belly is uniform yellowish.

DIPSADOMORPHUS MULTIFASCIATUS (BLYTH).

A very juvenile specimen, probably a hatchling, measuring 11¼ inches, was killed at Naini Tal, and presented by Mr. G. O. Allen.

It is not such an uncommon snake in the Western Himalayas as records might suggest. In the Indian Museum there are specimens from Subathu, Mussoorie, and Naini Tal; it has been recorded by Anderson from Simla, and I have had two specimens from the Naini Tal District, two from Mussoorie, and no less than seven reached me in 1914, from Muktesar. It would appear therefore to be as common in the Western as in the Eastern Himalayas, and to favour an altitude above 5,000 feet.

HYDROPHIS CÆRULESCENS (SHAW).

The receipt of a gravid ♀ from Alibag, donor Mr. Alcock, affords useful information of the breeding season. It was captured in June 1917, in the very month and year that I captured the first specimen to shed any light on the breeding season. My note appeared in this Journal in Vol. XXV, page 308. Mr. Alcock's specimen measured 2 feet 5 inches, and contained 5 embryos in an advanced stage of development, though not sufficiently advanced to make a study of the lepidosis possible. The brood comprised ♂ 4⅜″, ♂ 4¼″, ♂ 4 3/16″, ♀ 4⅛″, and ♀ 4¾″.

I have now examined well over 60 of this common snake, and it is perhaps remarkable that only 5 have proved to be gravid. A specimen in the Indian Museum 2 feet 2¼ inches long contained 5 eggs. Another in the same collection 3 eggs, and a third 6 fœtuses. No dates of capture were available with any of these. The specimen I recorded to which an allusion has been already made, was 2 feet 4 inches long, and contained 4 fœtuses, one retained from a previous brood. It is evidently not a prolific species, the young varying from 3 to 6.

HYDROPHIS MAMILLARIS (DAUDIN).

A fine specimen of this rare sea-snake is an important addition to the Society's collection. It was sent by Mr. Alcock from Alibag. It is a ♀ measuring 28¼ inches.

The scale rows two headslengths behind the head are 28, in midbody 37 and two headslengths before the vent 35. The ventrals number about 339. The neck is about one-third the greatest depth of the body.

There are 10 posterior maxillary teeth. 40 black bands encircle the body, and these are about twice the breadth of the intervals. They are confluent ventrally as high up as midcosta posteriorly. The tail is completely black.

I have seen only seven other specimens; four in our Society's collection, two in the British Museum, and one in the museum of the Royal College of Surgeons, London.

HYDROPHIS ORNATA (GRAY).

A well grown ♀ specimen of this uncommon sea-snake was acquired from Major Gharpurey, captured at Jask in the Persian Gulf.

The scales two headslengths behind the head are 32, at midbody 41, and two headslengths before the vent 42; subimbricate anteriorly, juxtaposed in the middle and posteriorly. The ventrals are about 360. Otherwise it is a very typical specimen. The posterior maxillary teeth number 11 on the left side. It is just the kind of specimen that so many herpetologists would make the type of a new species, on the abnormally large ventral count (210-300 Boulenger), and the abnormally low number of anterior scale rows (35 to 42 Boulenger), and on this account it would find a more fitting resting place on the British Museum shelves than in our Society's collection.

HYDROPHIS VIPERINA (SCHMIDT).

A fine ♂ was presented to the collection by Sir Charles Bailey, captured on the Orissa Coast.

The scale rows two headslengths behind the head are 33, at midbody 49, and two headslengths before the vent 42. Ventrals about 276. Here again the numbers of scale rows (27 to 29 on neck, and 37 to 43 on the body, Boulenger), would tempt some to pronounce this is new species. The fact that the præfrontal does not touch the second labial that the frontal is as broad as long combined with the extraordinary breadth of the anterior ventrals, (fully 3 times that of the last costal row) leave no doubt as to its identity. The posterior maxillary teeth number 5 on the left side.

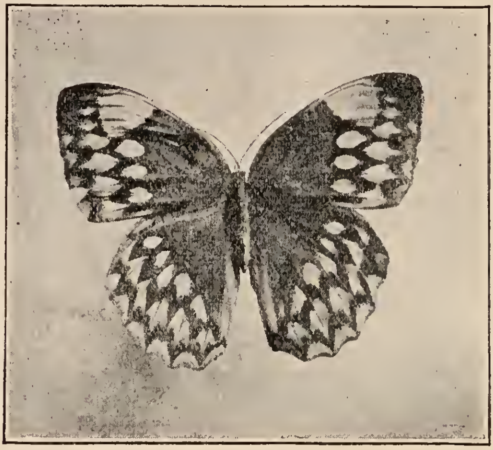
F. WALL, LIEUT.-COL., I.M.S.

BANGALORE.

No. XXXI.—OCCURRENCE OF *STICHOPTHALMA GODFREYI* (ROTHS.)

A specimen of this *Stichopthalma* was taken at Taungshum Taung, Tavoy district, on the 17th May 1917, and came into my possession. It was identified by Mr. Ernest Swinhoe who informs me that the type specimen was taken by Mr. Godfrey in Siam and is now in the South Kensington Museum. Though I visited Tavoy in February last I was not successful in getting any, but a forewing of one, that had probably been eaten by some bird, was found, and pointed to the fact that others were about. I enclose a painting showing the upperside, to full scale. On the underside the markings resemble *S. camedara* to some extent but there are only two ocelli on the fore wings, and three on the hind wings. The ground colour of the underside is a dark fulvus, the ocelli which are chestnut in colour, are surrounded by a black ring with white pupils.

Since writing the above I have received another specimen.



For the information of collectors who do not know this butterfly, I add the original description by Lord Rothschild in the Annals and Magazine Nat. Hist. (8), Vol. XVII, p. 474.

" ♂. This very distinct species is nearest to *St. cambodia*, Hew.

Upper surface.—Head brownish rufous; antennæ rufous; thorax and abdomen greyish brown, abdomen washed with blackish. Fore wing: basal half greenish steel-blue washed with olive-brown on costal area and from the base distad; outer half greenish white or white tinged with Nile-green; terminal band, apex, and submarginal row of large, excised patches black-brown washed with steel-blue; a postmedian band of dark greenish steel-blue chevrons joined into a chainlike band. Hind wing similar, only the submarginal band of excised patches is replaced by a second row of chevrons and the white ground of the outer half of the wing is strongly suffused with greenish lavender-blue. Underside very similar to that of combodia, but much darker; all the lines and other markings much sharper and the double submarginal bands deep brown.

Length of fore wing 72 mm., expanse 151 mm."

O. C. OLLENBACH.

DEHRA DUN, 28*th April* 1919.

No. XXXII.—OCCURRENCE OF *COLOTIS VESTALIS* AND *AMATA* AT UNAO.

On 3rd May this year at Unao (38 miles S. W. of Lucknow) while investigating a plot of babul jungle known locally as the "Babuli" for birds' nests I came across two kinds of *Colotis* that I had not personally taken before.

I took the first opportunity I could of revisiting the spot and on the 6th took a number of what proved to be *Colotis vestalis.* Most of them were in fresh condition. The ♀ was far less numerous than the ♂. They were on the wing soon after sunrise but were not very easy to secure as the undergrowth they frequented was a mass of thorny bushes

Associated with them were some *C. amata* of which I also obtained a few: these were not nearly so common as *vestalis.* These on being examined proved to be the *calais* form found in the Punjab and not the *amata* of Central and Southern India.

As I cannot find in the Journal any mention of *C. vestalis* having been taken anywhere near this locality, it may be of some interest to record it.

These *Colotis* appeared to be very local as I did not notice it anywhere else beyond a quarter of a mile of this spot.

G. O. ALLEN, I.C.S.

LUCKNOW, 15*th May* 1919.

No. XXXIII.—EARLY APPEARANCE OF *PIERIS BRASSICÆ*, (LINN) IN THE DARBHANGA DISTRICT, BEHAR.

I caught a female specimen of this common butterfly in my garden on the 8th January and a male on the following day. This is three weeks earlier than the usual time of these butterflies appearence which is about the 1st of February.

I saw no others till about a week later and they were not really plentiful till very late in February.

CHAS. M. INGLIS.

BAGHOWNIE FLY, LAHERIA SARAI.

No. XXXIV.—NOTES ON THE HABITS OF BUTTERFLIES *ZEUXIDIA MASONI* AND *XANTHOTÆNNIA BUSIRIS.*

I think there are few collectors who have had the chance of taking the above-named species, so that the following notes may be of interest to readers of this Journal.

Both these insects are very difficult to come by as they fly only after sunset and are to be found in dense forest covered country.

In Tavoy district about 16 miles N. E. of the town, at a place called Yeawine, I came across this species and was fortunate enough to take a few of each. *Z. masoni* I found high up a dry nala (stream) near the crest of the hill. The nala was deep and narrow and was practically choked with undergrowth, while giant forest trees towered overhead. At a spot a few yards below the crest and for a length of about 100 yards down the nala this butterfly was to be seen, but not above or below. The males would appear first and would take up positions on some suitable leaf overhanging the stream and from these points of vantage, no doubt, watch for the females, which come much later. If by chance another male came along one of those on watch would immediately attack it and there ensure a battle which lasted till one of the combatants was beaten off and the two would part to take up new positions. By watching carefully where they settled I was able to take a few specimens, but many got away in the darkness. The females did not settle, but flew down the stream at a fair pace for a certain distance and then disappeared up the hill sides. This species appears to fly only during the evenings, for though I visited the place before dawn I did not see any. It has a weak hopping flight and settles frequently, even when disturbed. I did not notice that the males gave out any odour, as stated by some collectors, but my companion assured me he could detect it, so I suppose I must take his word for it.

Xanthotaenia busiris. I took in the same stream as *Z. masoni*, but much lower down, near the base of the hill where the stream spreads out into a bog.

This insect is crepuscular but occasionally flies by day light. It was always to be found in the bog during day-time, sitting on dead leaves, and when flushed would fly a short distance and settle. Its flight is very like that of *Mycalesis visala* and is most difficult to spot when sitting, as the colours of the underside harmonize with its surroundings. It is a wary creature and needs some stalking to bring it to bag. By visiting this spot repeatedly I secured several specimens, all of which, with one exception, were males. The female is larger but otherwise there is no difference between the sexes in colour.

O. C. OLLENBACH.

DEHRA DUN, 25*th April* 1919.

No. XXXV.—NAINI TAL BUTTERFLY NOTES.

With reference to the list of the Kumaon Butterflies at page 133, Vol. XX of the Journal, the following notes may be of interest :—

Orinoma damaris, Gray.	On 23rd May 1916, I took one of these at exactly the spot mentioned in the list.
Mycalesis visala, M.	Took one below the Brewery on 11th October 1916.
Aulocera sarasvati, Koll.	Found this common in September 1916 along with *A. swaha. Saraswati* prefers the sunshine while *swaha* is fond of sunlit patches amongst the trees and bushes.
Lethe vaivarta, Doh.	Very common in October 1916, down the Ratighat road.
Eulepis dolon, Wd.	In the very dry season of 1916, I took a couple at Sarria Tal on 5th May: I once had two under my net at the same time. Took another on 13th in a nala down the Ratighat road: saw one or two others about the place. At the beginning of June 1917, I saw an odd one down the Fishponds valley.
Auzakia danava, M.	The ♀ is common than the ♂.
Neptis mahendra, M.	Took this at water which I believe is unusual.
„ *narayana*, M.	Found this very common in the middle of May 1916. This is also common at Mussoorie, though MacKinnon's list notes it as rare.
Issoria sinha, Koll.	Took one at Cheena Chowki on 20th October 1916.
Papilio cashmirensis, Roth.	Took a very damaged specimen on the top of Alma on 29th June 1917.
Zepherus icana, M.	One taken on 8th October 1917 down the Fishponds valley.
Euaspa milionea, Hew.	A single one taken on 19th May 1916 down the Ratighat road. This insect is abundant during the latter part of May and in June in the nalas at Mussoorie, which would appear to be about the limit of its range to the East.
Tajuris maculata, Hew.	A ♀ w. s. f. taken on 8th October 1917 in the Fishponds valley.

G. O. ALLEN, I.C.S.

DEHRA DUN, 9*th March* 1919.

No. XXXVI.—LIFE HISTORY NOTES ON COORG BUTTERFLIES.

I do not think that the puzzling distribution of the S. Indian *Ypthima* has yet attracted the attention it deserves.

Starting in the extreme South with *Y. ypthimoides* of Travancore and the Tinnevelly hills with a slightly differentiated form on the Palnis in the neighbourhood of Kodaikanal, we find its place taken on the Anamialais by *Y. chenui*. This exceedingly weak-flying species seems to have had no difficulty in crossing "the Palghat gap", that well-known Zoological barrier for many species, and is found in suitable localities on the Nilgiris in small colonies. Between the Nilgiris and the Brahmagiris there is a distinct break in the Western Ghats, so that it is not surprising to find *Y. chenui* absent on these latter hills though they run up to nearly 6,000 feet. However, it turns up again in the next high range northward, the Western Ghats in Coorg with their highest peak Tadiandamol (5,730 feet). On this hill and on another peak slightly S. of it at the summit *Y. chenui* is abundant enough, but extremely local, only occurring where the forest fires have spared the tender grass on which its larva feeds. This grass (*Sathistira ciliata*) is common enough in Coorg, but at higher elevations cannot stand continual burning. At all events I have failed to find *Y. chenui* further northward along the Western Ghats where *Y. philomela* suddenly makes its appearance flying freely W. of Mercara during and after the S.-W. monsoon. I have never found *Y. philomela* in S. Coorg nor on the Western Ghats, S. of Mercara, though it is fairly abundant in the Nilgiri Wynaad over 50 m. to the S. of Mercara. N. of Mercara it will only be found sparingly in open grass land.

The discontinuous distribution of all these S. Indian grass-feeders may perhaps be attributed to the prevalence of grass fires all along the Western Ghats from the Cardamon Hills in Travancore to the Baba Budens in Mysore. At all events the discontinuity is worthy of note.

Pollibetta (*26th April* 1918). Saw an amusing encounter this morning between a crow and an Atlas moth. At first it looked 10 to 1 on the crow as the moth—a female—was apparently flying in an utterly dazed fashion. Each time, however, that the crow made a dash, the moth "jerked" in some extraordinary way, escaping death by inches each time. After about five futile attempts the crow got disgusted and flew into a neighbouring teak tree. The moth at once settled in full view of the crow, but to my astonishment the latter made no attempt at the sitting shot and shortly afterwards flew off leaving the moth in possession. As a rule the Atlas moth keeps to fairly thick jungle and one rarely sees them in the open where a bird can get a good view of them. Apparently, even in these unfavourable circumstances, a slow-flying moth can keep it's end up. In Coorg the most usual food-plant of the Atlas moth larva appears to be *Ardisia humilis*, though I have also found it on *Carega arborea*. The life of this moth in a perfect state must be very short, its size making it so conspicuous and it does not appear to be protected.

After several unsuccessful attempts extending over three years, I succeeded in 1918 in breeding out *Cyaniris limbata* ♂ and ♀, a species which has not been bred hitherto. The food-plant is a *Hiptage* (Nat. Ord. Malpighiaceæ) growing on the Downs near Mercara and apparently midway between *Hiptage madablota* and *H. parviflora*; the leaves and flowers resembling *parviflora* while the seeds are winged as in *madoblata*. This scandent shrub is only in flower near Mercara from January to March. The butterfly is common all through the year and must therefore have other food-plants, since the larva appears to feed solely upon the flowers. I have never observed it eating the leaves nor making any attempt in that direction.

Description.—The *egg* is sea-urchin shaped, finely reticulated and greenish white.

The *larva* is apple-green on emergence, covered with sparse white hairs. It immediately bores inside the flower-bud and after its first month turns a dull pinkish red, matching the buds of its food-plant.

When full fed, the head is yellowish brown, the body dull coral pink, with a dark red dorsal stripe, covered with white bristles, which under a microscope disclose a hexagonal stellate process near the base of each.

The larva is full fed in about 16 days when it is 10 m.m. long × 4 m.m. broad at the widest segment.

The *pupa* is of the usual squat, *Cyaniris* shape, dull green blotched with brownish 8 m.m. in length and 3·5 m.m. broad; the wing cases marked with minute black dots and naked, the body covered with a fine pubescence.

My specimens remained nine days in the pupal state, hatching out on 1st March 1918. The larvæ are attended in a desultory fashion by ants, but are evidently able to get on without their assistance. While conducting experiments with the Mercara *Hiptage* I came across several Hesperid larvæ which all appeared to belong to one species till their emergence in March 1918, when it was found that the smaller specimens were *Bibasis sena*, and the larger ones *Ismene fergusonii*.

Identity of marking, food-plant and habits in the early stages would seem to show that these butterflies are even more closely allied than is generally supposed and that they might well be placed in the same genus.

F. HANNYNGTON, I.C.S.

BELLARY, 20*th Feb.* 1919.

[Since the above note was written we regret to say Mr. Hannyngton died. We hope in the next number of the Journal to publish an obituary notice—EDS.]

No. XXXVII.—THE HAWK MOTH (*DEILEPHILA LIVORNICA*). A CORRECTION.

In October 1916, I sent some Hawk moths to you for identification. One of these you identified as *Deilephila livornica*, and in Vol. XXV, No. I of the Journal, you printed an article of mine on the moth under the above name.

Some time afterwards I came to doubt the identification, and sent the moth to Mr. T. R. Bell, and on his recommendation to Sir George Hampson.

I have now heard from the latter that the moth is not *Deilephila livornica*, but *Celerio euphorbiæ*. Linn. Var. *nervosa*, Koths.

Sir George Hampson says that there are only two specimens of the moth in the British Museum, and he would like a good series.

If there are any members of the Society near Murree who are keen on collecting, I could tell them where they could obtain numbers of specimens.

F. B. SCOTT, CAPT., I.A.

ALLAHABAD, 16*th Feb.* 1919.

No. XXXVIII.—*HARPACTOR COSTALIS*, STAL., PREYING ON *CERATINA VIRIDISSIMA*, D. T.

On the 16th April I caught a *Harpactor costalis*, Stal., busy sucking a *Ceratina viridissima*, D. T., which it had evidently caught on a sunflower.

This is a very common predaceous bug here and Lefroy mentions its preying on *Dysdercus cingulatus*, Fabr., the Red Cotton Bug, but I am not aware whether it has been previously recorded as preying on the little bee, *C. viridssima*.

CHAS. M. INGLIS, M.B.O.U.

BAGHOWNIE FTY., LAHERIA
SARAI, 10*th May* 1919.

No. XXXIX.—NOTES ON THE FLYING WHITE ANT AND SCORPIONS THAT FEED ON THEM.

Actual personal observation, 9-0 a.m., 11th June 1919, at Jamshedpur (late Sakchi), in the province of Bihar and Orissa, on the works of the Burma Mines, Ltd.

This morning at about 9-0 a. m., after a good deal of rain during the night, millions of the winged variety of the white ant (termites) started coming out of their nests in and above the ground—and it was most interesting watching them issue forth, in numberless legions usually four abreast at a time—from horizontal openings or slits in the dome of their spire-like dwelling. They practically pushed themselves out, in blind instinct like compliance with a law of nature—and with them came out also numberless ordinary (wingless) ants—seemingly younger ones—only to crawl about and return to their chambers underground.

None of the winged insects came out of the usual bore holes one sees all around a good sized nest, but from newly made slits about three inches long by one-half inch wide.

From the bore holes, however, came out a regular platoon of scorpions—large and small—who at once shikared the flying ants, and most dexterously caught them in their front claws from whence they transferred them to their mouths. The largest scorpion was eight inches long, black as ink, and the smallest, one inch long, also black. The colour of the scorpions varied from a dirty brown to ink black, and some had a tinge of red. The number that came out that I could see were twenty-four, others may have been hidden in the scrub brush that grew over the nest—and all were partaking of a sumptuous succulent feast. The scorpions were most alert, and quite alive to the fact they should make hay while the sun shone, literally—and packed up as tightly as possible between their claws and their mouths, as many winged insects as they could conveniently hold. One—the biggest—secured forty-six of them, he was a monster. He very adroitly placed himself over an opening, from which files of four were issuing in a constant stream. He usually caught them fair and square and pressed them home to his mouth very easily—but sometimes he got hold of one of their wings, with his claws, and with a tender embrace conveyed the helpless creatures to his mouth—which in a very short time became a temporary larder, pulsating with life and trembling wings.

A crowd of Indian workers of the Company soon collected round the yellow mud edifice, where this struggle between life and death was going on, and amongst them were some Santal and Kol women who wished to share the spoil with the scorpions. They brought brass bowls, half filled with water, into which they quickly and very nimbly dropped such of the flying ants as they could catch, keeping an eye on the scorpions at the same time. All the ants they collected are subsequently deprived of their wings and then eaten, fried generally in oil. I have heard of the wild tribes in India sometimes eating locusts and even snakes, when they are hungry, but have not before noticed that the flying white ant was collected for a meal.

The cessation of the exodus of the ants was also a signal for the scorpions to disappear too, and within a few minutes they scurried back into the bore holes—deep down in the earth nest. I dug off several feet of the top of the nest, and came across several sponge like structures, pulsating and swarming with life, in cup-shaped casings containing embryo ants and eggs, but no scorpions. These had gone deep down into the earth—there in unmolested silence and darkness to enjoy the rich feast they had secured and thus gorged to await another favourable opportunity during the rains, for repeating the operation.

The scorpions did not use their stings or tails for any purpose whatsoever —these were well curled over their backs, but their claws in front were constantly spread out to catch and embrace all that came within striking distance.

I also noticed that there were many Santal and Kol women willing to kill the scorpions, and collect them—if allowed by me—as they said a good oil, useful to be rubbed on for aches and pains in joints, could be extracted from their bodies. I preferred, however, watching these dreaded insects at their shikar game to seeing them killed—and all one heard when the nest was once more normal and showed no signs of life was "Bab-ra-bab-kitta bichoo"—"My father, how many scorpions,"—and that was all one could say—for never have I seen so many scorpions in one particular spot.

Evidently the sandy yellow clay soil, and also the lateritic soil all round here, harbours hundreds of scorpions, centipedes and snakes, as I have come across more than one usually sees elsewhere in India.

The Indians of these parts, who were watching the nest with me, stated that it was the turn of the scorpion now, as he was eating the white ants, but a time would come when the white ants would cluster all round and eat the scorpion, and that it was usual for this to happen, but I have no convincing evidence.

C. H. DRACOTT.

JAMSHEDPUR, *24th June* 1919.

No. XL.—NOTES ON SOME NEW AND OTHER INDIAN DRAGONFLIES.

ÆSCHNIDÆ.

Subfamily *Æschninæ*.

1. *Hemianax ephippiger*, Morton, Trans. Ent. Soc., London, 1907.

The breeding places of this insect in India are small tanks and reservoirs, usually of considerable depth and rich in water weed. The greater number emerge as the imago, during the month of April. I noticed over one hundred exuviæ clinging to a small tuft of reeds in a tank at Poona, the tank measuring only about 15 feet either way and its waters swarming with the full grown larvæ. A large number of these were collected and emerged in the next few days, the greater number being males.

There were a few isolated specimens of *Anax guttatus* amongst them.

Females of these dragonflies are rarely seen on the wing and are much more easily obtained by breeding out the larvæ. It is quite easy to distinguish the sexes in the last instar of the larvæ as development of the genital organs is well advanced and moulded on the ventral plates of the abdomen. The females may be picked out and males, if not wanted, can be restored to their watery habitat. Another advantage of this method is that teneral specimens have the gut and ovaries empty and so no decomposition goes on after death and the colours do not fade. Colour develops very rapidly in the Æschnidæ, the species quoted above emerging at about 11 o'clock at night and having a good display of colour by the hour of dawn. Even before they emerge from the pupa case, the colour of the insect may be seen showing through, especially the blue at the proximal end of the abdomen. I found that the percentage of exuviæ worked out as 2 to 1, male and female respectively, so that the scarcity of females is real and not apparent.

2. *Orogomphus xantheptera*, sp. nov.

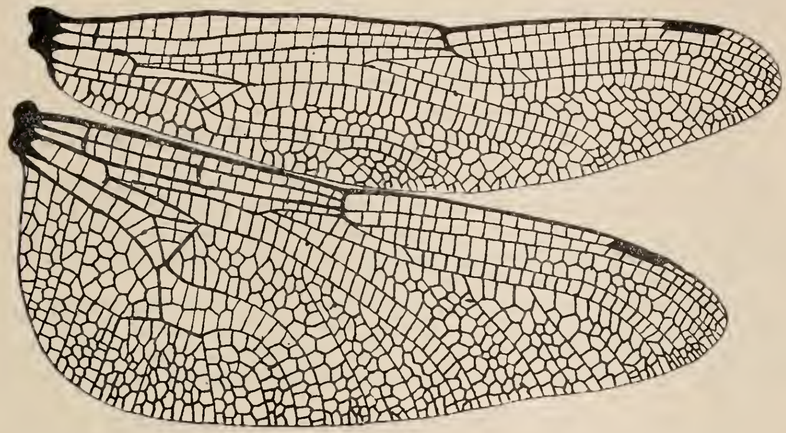
1 ♀, Madura District, South India, Mr. Prater, 1917. Type specimen in the Bombay Natural History Museum.

Length of hindwing 56 mm. Length of abdomen 54 mm. Breadth of hindwing 20·5 mm.

Head very broad, frons much elevated, considerably higher than the occiput and with a broad, diffuse brownish black, basal line, rest of frons, face, labrum and labium bright yellow, occiput black, fringed with stout, yellow hairs.

Prothorax very small and tucked away out of sight beneath the head.

Thorax cubical, relatively small, brownish black with yellow markings, as follows :—a narrow, humeral streak, angulated inwards above and then turning downwards parallel to the dorsal carina for a short distance, a broad lateral fascia under the forewing and another on the posterior part of the metepimeron.



Wings deeply and evenly saffronated throughout the whole of their extent although there is some hyaline cellular mottling. Stigma black.

Antenodals $\frac{24}{18}$, postnodals $\frac{13}{16}$, median nervures $\frac{4}{3}$, cubital nervures $\frac{9}{8}$,trigonal cells $\frac{3}{5}$, hypertrigonals cells $\frac{5}{5}$, anal loop 22 cells, squarish [and consisting of an outer and an inner circle of cells.

Abdomen : 1st and 2nd segments dilated, 3 to 6 narrow, 7 broadening apically, 8 and 9 dilated and then tapering to the 10th which is small. Black marked with yellow as follows :—1st segment with a somewhat triangular patch on the dorsum and the side broadly yellow, the marking here, broadening proximally ; 2nd segment with small transverse lunules on the dorsum, proximal border and the side broadly, the marking here, narrowing proximally, 3rd segment with similar markings ; 4th to 7th with dorsal lunules only ; the remaining segments unmarked but the lunules may have become obscured through decomposition.

Legs black. Anal appendages small, black. Vulvar scale broad and depressed, slightly overlapping the 9th ventral plate.

3. *Macrogomphus annulatus*, de Selys.

1 ♂ and 1 ♀ apparently taken *in cop.* Madura District, 1917. Mr. Prater.

Length of abdomen 50 to 52 mm. Length of hindwing 38 to 40 mm.

These two very rare insects are in a well-preserved condition and correspond closely to type. The superior anal appendages are creamy white, nearly evenly forked and with a small ventral tooth ; inferior appendages black; both pairs evenly and widely divergent. The oreillets of the female are about half the size those of the male.

This pair of insects are in the collection of the Bombay Natural History Museum.

LIBELLULIDÆ.

Subfamily Libellulinæ.

4. *Diplacodes parvula*, Rambur, 1842.

This insect is very closely related to *D. nebulosa*, differing from it by possessing a blackish basal spot to the hindwing and by not possessing apical markings. It almost entirely replaces *D. trivialis* in Mesopotamia and in part at least, in N. W. India. The insect is fairly common in Karachi.

AGRIONIDÆ.

Subfamily Protoneurinæ.

5. *Disparoneura fletcheri*, sp. nov.

2 ♂ ♂, and 2 ♀ ♀. Shillong, September 1918. T. Bainbrigge Fletcher.

Length of hindwing 23 mm. Length of abdomen 31 mm.

Male: Head, eyes reddish brown above, paler beneath, an equatorial, brown line separating the two coloured areas, labrum rust red, with a row of small black spots along its border, rest of head black marked with a broadish rust red band crossing between the anterior part of the eyes and two obscure spots on the outer side of the lateral ocelli.

Prothorax black marked with longitudinal, red, subdorsal stripes and with a minute dorsal, geminate spot on the mid-lobe and a single, tiny spot on the dorsum of the posterior lobe. Lateral border of middle lobe, narrowly red and two minute red spots on the posterior border of the posterior lobe.

Thorax rust red on the dorsum, fading to a pale fleshy tint laterally. Marked very irregularly and variably with black as follows :—a broad, middorsal band, another broad, subdorsal band, incomplete above and behind where the ground colour invades it irregularly. A line on the 2nd lateral suture, split more or less longitudinally and irregularly and an elongate spot on the metepimeron. Tergum mottled with rust red.

Abdomen black marked with red or wedgewood blue. The apical border of the first segment red ; a longitudinal, fine red line on the dorsum of the second segment ; 2 subdorsal lunules on the apical borders of segments 3 to 7. Obscure reddish or bluish spots on the sides of segments 3 to 6. The sides of the first and second segments red or purplish.

In some specimens the ground colour or markings are entirely wedgewood blue but they do not appear to be more adult than the red-marked ones, in which, especially on the head, the red is of a very intense character.

Legs black, base of femora and extensor surfaces of tibiæ rust red.

Anal appendages of the usual disparoneurine shape, the superior with pointed apices and a robust ventral spine and the inferior sloping and tapering ventrally and rather longer than the superior.

Wings distinctly tinted, especially along the costa and apices ; stigma crimson, the hinder border paler.

Female similar to the male, the markings being rather more defined and very irregular.

6. *Caconeura mackwoodi*, sp. nov.

1 ♂ Dyatalawa, 5,000 feet, Ceylon. September 1916.

Length of hindwing 21 mm. Length of abdomen 32 mm.

Head jet black with a purple sheen.

Prothorax and thorax jet black, the dorsum a deep metallic purple ; on the sides of thorax, two dirty yellow, narrow lines, starting from the middle and hind coxæ respectively.

Abdomen deep black, no markings.

Anal appendages strongly resembling those of a *Disparoneura.* The superior with a robust ventral tooth, the inferior directed ventrally, apering to the end, somewhat broad at the base and slightly upturned at he extremities.

Wings: stigma black, strongly braced; 17 postnodals in the forewing, 15 in the hind, *ab* fails for a short distance, to meet Cu_2b in all four wings, Cu_2 less than half the wing length.

I took this solitary specimen in a dark, rocky gorge occupied by a mountain torrent and only secured it after a rather perilous climb, which I should not have attempted unless I had previously spotted the insect from above with field-glasses. I find this instrument as valuable to the odontologist as to the hunter after more noble game, both for the purposes of detection and observation.

7. *Caconeura canningi,* sp. nov.

1 ♂ Coonoor, 6,000 feet, Nilgiri Hills, May 1917.

Length of hindwing 20 mm. Length of abdomen 32 mm.

Head velvety black, no markings.

Prothorax black, no markings.

Thorax black with a posthumeral, yellow line on each side and an incomplete, similar coloured line starting from the hind coxa and not reaching the metepemiron. Ventral surface pruinose. Legs black.

Abdomen black. Minute white lunules at the basal ends of segments 3 to 6 ; a fine, white, dorsal line on the 2nd segment; a similar coloured ring to the first segment and obscure lateral spots on the distal third of segments 3 to 7.

Anal apendages very similar to the last.

Wings: stigma black, covering not quite, I cell, its costal s de longe than the posterior, postnodals 15 in the forewing, 13 in the hind, only a vestige of *ab* present, almost absent in the hind wings, Cu_2 not half the wing length.

Subfamily AGRIONINÆ.

8. *Enallagma assamica,* sp. nov.

Several ♂ ♂ and ♀ ♀. Shillong, Assam, T. Bainbrigge Fletcher. 26th October 1918.

Length of hindwing 17 mm. Length of abdomen 24 mm.

Head: eyes bottle green at the sides, paler beneath, black above ; post-ocular spots blue and joined across the occiput by a line of the same colour; labrum pale blue, black at the base ; rhinarium blue, with a black spot above; a pale blue line crossing the frons between the eyes in front of vesicles.

Prothorax black, the sides pruinose.

Thorax black on the dorsum, pruinose on the sides, marked with fine, blue, humeral lines. Legs whitish, the femora streaked with black on the extensor surfaces.

Abdomen very attenuated as far as the 7th segment and then expanding gradually to the 10th Pale greenish-blue except segments 8 and 9 which are a deep sky-blue with no markings, the row of spines on the proximal border of these two segments being blue also; broad, dorsal, black markings on all segments except 8 and 9, the markings expanding proximally on each segment and tapering very slightly apically. Black annules at the junctions of each segment, connected with the dorsal black markings. Usually pale blue annules at the proximal borders of segments 1 and 2.

Anal appendages nearly as long as the 10th segment, concave internally, bifid at the end very much as in *P. decorum*. The inferior small and whitish.

Female somewhat similar to the male but paler in colour. The black markings slightly more extensive and involving the dorsal surfaces of segments 8 and 9 also. 10th segment pale blue instead of black as in the male. Ground colour more green than blue and the sides of thorax not pruinose. The black on the upper surface of the eyes is sharply limited and the sides and under surface are a paler green. There is also a pale brown, equatorial line running through the pale area.

The legs yellowish at their bases.

Wings: stigma dark brown, unicolourous; *ab* commences at the level of *ac* as in true *Pseudagrion* and the female has a ventral spine on the 8th segment.

F. C. FRASER, MAJOR, I.M.S.

BOMBAY.

No. XLI.—ANTS ATTACKING BEES.

I am not a member of your Society; though I have often thought I should like to be, but venture to write and inquire as to whether an attack by red ants (Burmese Kagyin, I don't know their scientific name) on bees has ever been recorded? There are numerous colonies of these red ants round our house here. They have their nests in almost every tree. Yesterday, on my return from office, my wife mentioned that a column of red ants had come into the house and was disappearing through the bed room window in the direction of a bee hive, which has recently been established under the eaves, and we wondered seriously as to whether the ants were after honey. At night when we went to bed we heard an excited buzzing from the hive which astonished us, at such a time of night (10 p.m.). We investigated with electric torches and found a dense double column carrying dead adult bees. When we woke in the morning the buzzing was still going on, but there was a small volume of it. On investigating again we found the grewsome procession of corpses was still pouring down the window still and out unto the wall outside, bees were buzzing about while a number were hanging to the window curtains as if exhausted. These were being hunted up by the ants and we noticed that whenever a bee still on the wing approached the marching column the ants did their best to get hold of it while every now and then when a bee flew within reach it was seized and appeared to be instantly killed. Eventually a servant knocked down the hive and in a short while the remnant of the bees flew away and are now clustered on a croton column in the garden. I believe if the hive had not been knocked down every bee would have been killed. What astonished us was that the bees appeared to be able to put up no sort of fight. I noticed one or two dead ants being carried which looked as if perhaps a bee sometimes was able to make use of its sting. The ants are of the variety, about ½″ long, which cocks its "tail" and makes war ike demonstration when you put your fingure near it. They are fond of crowding into a garden gate awaiting nervous people about to open it.

A. G. H. BREITHAUPT.

SANDOWAY, ARAKAN COAST,
13*th March* 1919.

No. XLII.—HABITS OF EARTHWORMS.

At Naini Tal on 5th June 1917 while coming up along the Khairna road after a heavy shower of rain I found, all the way up to the top of St. Loo gorge, the whole ground strewn with quantities of worms all migrating up hill. They were coming from the lower side of the pathway and making their way up hill. All stretched out at full length they looked in places like a lot of scattered "spillikins." A week later I was coming up the same way—also after recent heavy rain—and the worms were still on the move. I watched some even climbing up the tree trunks which were often quite perpendicular. Their efforts to get up the steep bank on the upper side of the path often resulted in their tumbling down again. In the sunshine they showed in some lights a beautiful purplish colouring. I presume these worms thought it time to move higher up for fear of being flooded out.

G. O. ALLEN, I.C.S.

DEHRA DUN, *9th March* 1919.

REVIEW.

A PRACTICAL HANDBOOK OF BRITISH BIRDS.*

This Handbook, Part I of which has just been received is edited by Mr. H. F. Witherby assisted by other authors in the various sections, whose names should guarantee that the handbook will have as claimed, easily accessible and reliable information concerning all British birds dealt with in a scientific manner, yet capable of being understood by beginners.

The first part was printed before the war but was held up and addenda have had to be added on the cover. The Introduction explains concisely the scope of the work and a glossary of terms, some diagrams showing various external parts of birds and how to measure are added. We then pass on to a Key of Orders, profusely illustrated by diagrams to show the distinctions, followed by a Key to the families of Passeres and a key to the Genera of the Corvidæ. It is explained in the introduction that these keys are not intended to be used as means of identification, but only as *guides*, and must be used in conjunction with descriptions. The rest of the part is taken up with the Crows, Starlings, Oriole and some of the Finches, a key to the Genera *Fingillidae* being given; under each species is given the English and binomial Latin names, the trinomial name being given if the species has been divided into subspecies.

For the benefit of Indian readers it is necessary to explain something about the nomenclature. In 1912 "A Handlist of British Birds" was written by some of the authors of this present work. The nomenclature there adopted was based upon the *tenth* edition of Linnæus (1758) and was in conformity with the "International Rules of Zoological Nomenclature" and the "opinions" of the Commission. This list altered many of the names which had been in use in England and elsewhere for long past, but it was hoped that uniformity in nomenclature would result from adopting these "strict priority" names. Since 1912 not a few of these names even have been altered again for one reason or another, and some have had to be even altered back to the names originally largely in use, *e.g.*, *Podiceps* vice *Colymbus* for Grebes and *Colymbus* vice *Gavia* for the Divers—on this 'Handlist' the nomenclature in the handbook is based, but revised and brought up to date, but it is too much to hope that even in the names in the Handbook will be final. By going back to Linnæus Ed. X as a basis theoretically we should obtain uniformity but practically uniformity is, we consider, impossible at any rate for many years to come, even if all were agreed to accept this basis (and some people and countries do not), for instance, great diversity of opinion exists over Genera while the acceptance or not of any given specific name is often not merely question of accepting the oldest name, but whether that name is applicable and here *individual* opinion will arise.

Under each species the descriptions of various plumages in detail and their moults, measurements, structure such as relative length of quills, etc., and colour of soft parts are given. The measurements of the wings of male and female are given, but as a rule only the measurements of the bill of the male which seems rather a pity; for instance, in the case of the two Nutcrackers (which only differ in their bills) the measurements of the male and female is given for one one, but only of the male of the other. We are glad to see it noted under each species how the measurements of the bill are taken, an essential point omitted in most books. Characters and allied forms are then enumerated very briefly, noting some of the other species and subspecies which are nearly related, how they differ and where they are found. Field characters showing the distinctive points to look for in the field are, we think, as innovation so far as British birds are concerned, and a very excellent one, well done, and close and original observation is evident in these paragraphs. Breeding habits then follows with a short description of eggs, etc., measurements, months of laying whilst the number of brood incubation and fledging periods are added where known. We might suggest that as the measurements of in some cases 100 eggs has been accomplished the extremes of size might have been given as well as the average. Food is next dealt with and these paragraphs contain some useful information ; distribution at home and abroad and migrations finish the account, these being concisely and accurately done.

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* A Practical Handbook of British Birds, edited by H. F. Witherby, M.B.E., F.Z.S., M.B.O.U. Authors of the various sections: Ernst Hartert, Ph. D., M.B.O.U., Annie C. Jackson, H.M.B.O.U., Rev. F. C. R. Jourdain, M.A., M.B.O.U., C. Oldham, F.Z.S., M.B.O.U., Norman F. Ticehurst, M.A., F.R.C.S., M.B.O.U. and the Editor. Witherby & Co., London, in 18 parts, price 4*s.* per part.

The beginner must be careful to remember that the keys are to be used as *guides* and not for ultimate diagnosis for which he must refer to the descriptions, otherwise he will find that if he has say Whiskered Tern before him, the key of the orders will guide him to the *Limicolæ* instead of the *Lari* ; or if he is endeavouring to place a Rosy Pastor in its right *genus*, according to the key of genera he will be guided to the *Bombycillidæ*. These mistakes in the keys together with confounding thigh with tibia on p. 3 we think might easily have been avoided otherwise the keys seem sound and no doubt will be very useful. We do not seem to have heard before that the Raven is an autumn to spring immigrant in Scotland and we wonder on what records this statement is based ; nor can we credit that the Hooded crow ever arrives in the Eastern countries as early as August 5th such records doubtless being referable to occasional birds which have passed the summer there.

The present part contains, besides numerous black and white diagrams, a coloured plate of the juvenile plumages of some of the Finches, sufficiently good for recognition and colored plates are promised for juveniles of all British breeding species (where different to adult). This will supply a long felt want. We do not see any mention of the artists name. The handbook is well printed on good paper and remarkably free from misprints (though there seems to be one somewhere on p. 27, line 31, as we can make no sense of the sentence). The information is sound, concise and up to date simply but scientifically put and if the other parts are equally good (and we are sure they will be) the work will be a most valuable book of reference to the ornithologist and beginner alike.

PROCEEDINGS

OF A MEETING HELD ON 1st JULY 1919.

A meeting of members of the Bombay Natural History Society, and their friends, took place on Tuesday, the 1st July 1919, Mr. John Wallace presiding. The election of the following 24 new members since the last meeting was announced:—

The Honorary Secretary, Victoria Memorial Park, Rangoon; the Rev. R. D. Acland, Sonai; the Secretary, Municipal Committee, Peshawar; Mr. S. L. Ajrekar, Poona; Mr. R. Du B. Evans, Baghdad; Dr. C. E. Forsyth, Borjuli, P. O.; Mr. F. Rutz, Karachi; Mr. V. P. Vaidya, Bombay; Dr. F. W. O'Connor, Cachar; Mr. D. Keiller, Muktesar; Mr. G. P. Goffi, Muktesar; Mr. J. A. Hearsey, Muktesar; Major C. P. Hill, Rangoon; Mr. L. A. Lampard, Quilon; Mr. L. M. Parlett, Coonoor; Mr. R. C. Morris, Attika, P. O.; Mr. R. Barton Johnstone, Mussoorie; Miss E. E. Smellie, Indore; Mr. G. W. B. Goodfellow, Ceylon; Prince A. R. Effendi, Rawalpindi; Mr. P. R. C. Williamson, Trichinopoly; Major C. B. Conaghy, I.M.S., Sehore; Mr. G. C. Stephenson, Europe.

The following contributions to the Museum were received since the last meeting:—

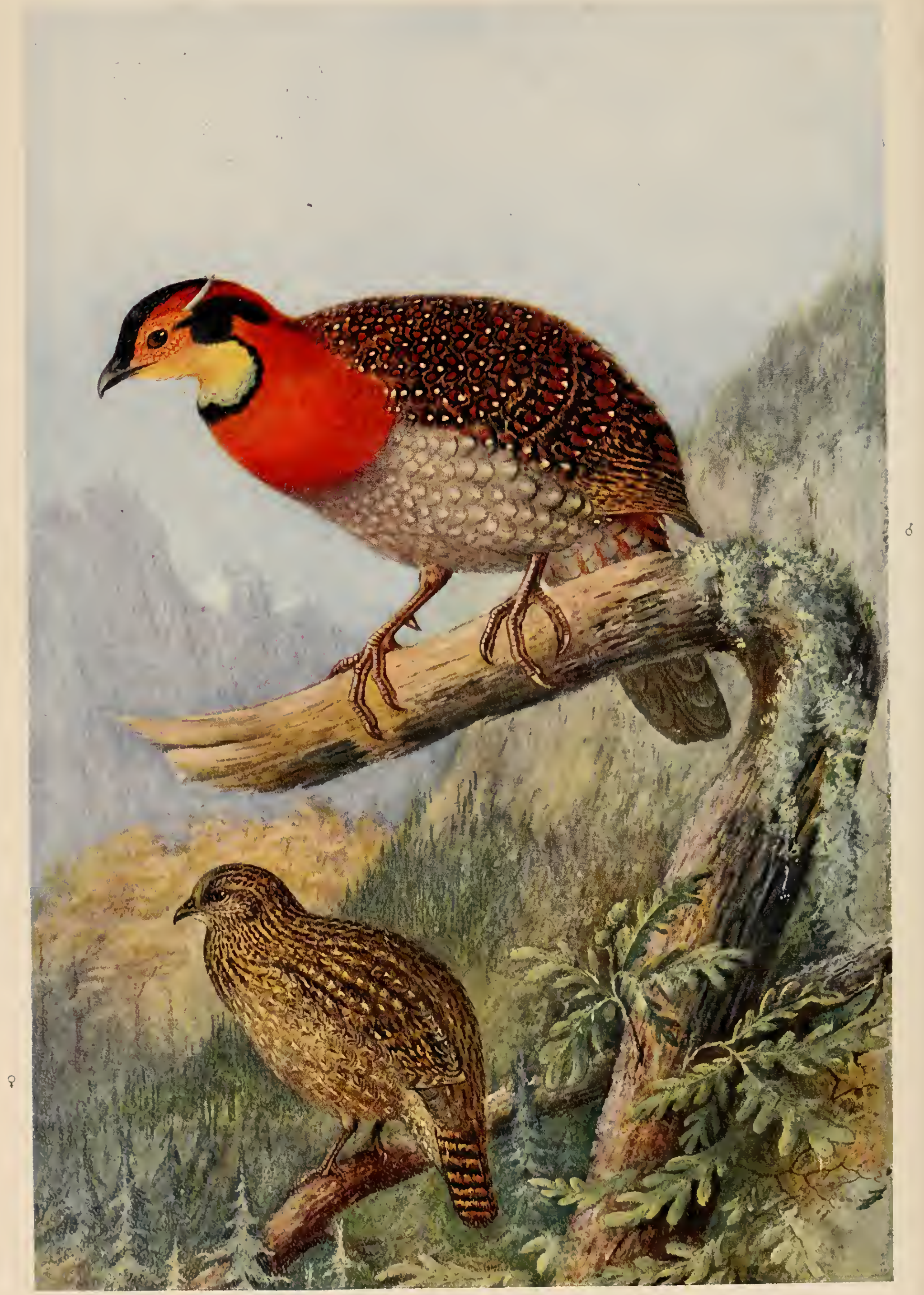
Contribution.	Locality.	Donor.
2 Gibbons (*Hylobates* sp.), 1 Crab-eating Mungoose (*H. urva*), 1 Small Indian Civet (*V. malaccensis*), 1 Golden Cat (*F. temmincki*), 1 Leopard Cat (*F. bengalensis*), 1 Tiger Civet (*P. pardicolor*), 2 Striped-necked Weasels (*M. strigidorsa*), 1 Flying Squirrel (*P. sybilla*), 2 Small Flying Squirrels (*H. alboniger*), 1 Short Tailed Mole (*T. micrura*), and 11 Snakes.	Burma-Yunnan Frontier.	P. M. Leonard.
3 Spiny Mice (*Acomys*) alive ..	Bushire	Capt. T. M. Lyle.
20 Small Mammals	Mesopotamia ..	Capt. C. Hobkirk.
120 Mammals, 27 Birds, 1 Snake and 18 Insects..	Shiraz	Lt.-Col. Hotson.
2 Pigmy Squirrels (*Hylopetes belone*) and 4 Eggs of Shikra (*A. badius*).	Sandoway ..	F. C. Purkis.
1 Red-bellied Squirrel (*C. erythraeus*), 4 Bird Skins, 2 Snakes and 1 Whip Scorpion.	Garo Hills ..	A. B. de Castro.
2 Palm Squirrels (*F. palmarum*)	Madras	Madras Museum.

Contribution.	Locality.	Donor.
3 Jungle Squirrels (*F. tristriatus*). 3 Palm Squirrels (*F. palmarum*). 3 Dusky Striped Squirrels (*F. sublineatus*).	Trivandrum ..	Trivandrum Museum.
1 Striped Squirrel (*F. pennanti*).	Nagpur	E. A. D'Abreu.
2 Striped Squirrels (*F. pennanti*).	Punjab	H. Whistler.
1 Hare (*L. nigricollis*) and a Snake (*S. brevis*).	Karwar	T. R. Bell.
1 Female Mysore Slender Loris (*L. lydeckerianus*) with two young-alive.	Mysore	Lt.-Col. F. Wall.
3 Gerbiles (*Gerbillus* sp.), 3 Rats (*Rattus* sp.) and 39 Bird Skins.	Mesopotamia ..	Sir P. Z. Cox, and Maj. R.E.Cheesman.
1 Avocet Sandpiper (*T. trekia*)	Karachi	Capt. C. B. Ticehurst.
1 Eagle Owl (Bubo sp. ?) ..	Mesopotamia ..	Maj. F. P. Connor.
6 Sea snakes	Siam	Mr. Malcolm Smith.
54 Butterflies, 1 Spiney Lizard (*U. loricatus*), 1 Javelin Sandboa (*E. jaculus*), &c.	Mesopotamia ..	Lt.-Col. H. Peile.
5 Birds' Eggs	Mesopotamia ..	Lt. S. G. Adams.
27 Butterflies	Mesopotamia ..	Maj. C. W. Watney.
1 Krait (*B. cæruleus*) and 1 Wolf Snake (*L. aulicus*)	Belgaum	Rev. F. F. Harvey.
1 Burrowing Snake (*Glauconia* sp.)	Mesopotamia ..	Maj. F. E. Venning.
Coral-bellied Cut-tail (*T. guntheri*) and Ring-tailed Rat Snake (*C. cantoris*)	Lebong	E. C. Linton.
1 Snake (*Calamaria pavimentata*) and 1 Pit Viper (*L. gramineus*).	Garo Hills ..	Mrs. Jackson.
Snakes, a few Spiders and Scorpions.	Muscat	Maj. S. K. Gharpury.
1 Brown Tree Snake (*D. trigonata*).	Mysore	Van Ingan.
54 Mammal Skins and 13 Birds.	E. Khandesh ..	G. Monteath.
34 Butterflies	Mussoorie ..	G. O. Allen.
1 Flying Lemur (*G. penninsulæ*), 1 Pigmy Squirrel (*H. belone*)	Tavoy	J. C. Hopwood.

Minor contributions from:—Curator, Trichur Museum, Lieut.-Col. E. J. Gregson, R. S. Maj., A. J. Lodge, A. G. Braithaupt, J. Harrison, Maj. F. C. Fraser, H. F. Lodge, and Maj.-Gen. A. Skeen.

Mr. Kinnear read a paper on "The former distribution of the Lion in Mesopotamia and India."

1874



VITTY & SEABORNE, LONDON.

TRAGOPAN BLYTHI BLYTHI.
The Grey-Bellied Horned Pheasant.
($\frac{1}{5}$ Natural Size.)

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JOURNAL
OF THE
Bombay Natural History Society.

JAN. 1920. VOL. XXVI. No. 4

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

PART XXVIII.

With a Coloured Plate.

(*Continued from page 715 of Volume XXVI.*)

TRAGOPAN MELANOCEPHALUS.

The Western Tragopan.

Phasianus melanocephalus.—Gray in Griffiths' ed. Cuv. iii. p. 29 (1829) (Almorah).

Satyra melanocephala,—Gray, Ill. Ind. Zool. 1. pls. 46, 48 (1830-32).

Tragopan hastingsi,—Vigors, P.Z.S. (1830) p. 8 ; Gould. Cent. B. Himal. pls. 63, 64, 65 (1832) ; Jardines. Nat. Libr. Orn. iv, p. 224. pls. xxv., xxvi. (1834) ; Hutton, J.A.S.B.. xvii. pl. 2, p. 695 (1848) ; Fitz. Atl. Nat. Vog., fig. 232 (1864).

Ceriornis melanocephala.—Gray, Gen. B. iii, p. 499 (1845) ; id. Cat. Hodgs. Coll. Mamm. and Birds ed. 1, p. 125 (1846) ; Blyth, Cat. Mus. Ass. Soc. p. 240 (1849) ; Gould, B. Asia. vii. pl. 45 (1855) ; Adams, P.Z.S. 1858, p. 498 (N.W. Himalaya) ; id. P.Z.S. 1859, p. 185 (Punjab Range) : Jerdon. B. Ind. iii, p. 517 (1863) ; Sclater, List of Phas. p. 10, pl. 10 (1863), (N.-W. of Simla and S. Cashmere) ; Pelzeln, Ibis. (1868), p. 320 (Koteghur) ; Stolizka J.A.S.B., xxxvii. p. 67 (1868), (N. W. Himalaya) ; Beavan, Ibis. 1868, p. 380 (Simla) ; Sclater, P.Z.S., 1870, p. 164 ; Elliot, Monog. Phas. 1. pl. 23 (1872) ; Hume's Nests and Eggs Ind. B., p. 522 (1873) ; Brooks, Str. Feath. iii. p. 256 (1875). (Mussoorie and Gangotri) ; Marsh, B. Nest. Ind. p. 59 (1877) ; Hume and Marshall, Game-B. Ind. 1. p. 143. pl. (1878) ; Marshall, Ibis. 1884, p. 422 (Chamba) ; Oates, ed. Hume's Nests and Eggs iii. p. 410 (1890).

Tragopan melanocephalus,—Ogilvie-Grant, Cat. Birds B. M., xxii. p. 275 (1893) ; id. Hand-L. Game-B., p. 224 (1895) ; Oates, Hand-L. Game-B. 1, p. 245 (1898) ; Blanf. Faun. Brit. Ind., iv. p. 101 (1898) ; Oates Cat. Eggs B. M. 1. p. 51 (1901) ; Ghigi, Rend. Au. Bologna (5) x. pp. 403, 404 (1903).

VERNACULAR NAMES.—Jowar (*Garhwali*), Jaghi, Jatjhi (*Busahir*) ; Sing-Monal (*N.-W. Himalaya*) ; Jigurana ♂, Bodal ♀ (*Kulu, Mandi, Suket*) ; Falgar (*Chumbi*).

Description—Adult Male.—Feathers of head, nape and parts surrounding bare skin of face and throat, black, the longest crest feathers tipped crimson; neck all round below the black, deep crimson-red; feathers of fore-neck and upper breast, which are very stiff and bristly, a gorgeous orange flame colour. Remainder of upper part and anterior sides of the neck and shoulders greyish ochre, vermiculated with black in bars, and with white ocelli surrounded with black. The inter-scapulars next the crimson neck are often more or less strongly tinged with rufous, and therefore appear darker and richer than elsewhere. The longest upper tail-coverts with black tips and large white central patches edged with rufous. Tail mottled black and ochre, with broad black terminal bars.

Shoulder of wing crimson-red; wing-coverts like the back, but the ocelli larger, and the ochre mottling greater in extent; primaries and outer secondaries brown with broken ochre bars and mottling; innermost secondaries mottled ochre and black with terminal heart-shaped white ocelli surrounded with olive-rufous and black, and also with a few olive-rufous, almond-shaped marks surrounded with black. Under wing-coverts mottled brown and ochre and marked with crimson. Axillaries deep brown.

Below the throat the under plumage is black, the feathers red at the base, showing through in patches everywhere, and with bold white ocelli. The flanks, vent and under tail-coverts are more or less mottled with ochre and brown.

Colours of Soft Parts—Irides, rich brown or hazel-brown; bill, black or blackish brown; orbital skin, bright red; horns, bright pale Prussian blue, sometimes with a tinge of green ("light blue" Blanf.); lappet, bright, fleshy pink, with a deep purple line down the centre, and with triangular patches of pale blue with the bases joining on the centre line. The edge of the lappet and the top next the bare cheeks is also pale bright blue. On the lower part of the cheeks there are greenish blue caruncles, which show up well when the lappet is extended; legs and feet fleshy grey or fleshy red, with a tinge of purple, deeper and redder in the breeding season than at other times, "pale flesh colour, approaching to white" (Hume).

Measurements.—"Length, 27 to 29; expanse, 37; wing, 11·25; tail, 10·5 to 11·0; tarsus, 3; weight, 4·5-lbs." (Hume).

The following comprises the measurements of 30 specimens in the British Museum, Tring Museum, etc. Wing, 257 to 290 mm., average, 274 mm.; tail, 221 to 247 mm., average, 237·5 mm.; tarsus, 78 to 97 mm.; all but one under 85 mm., and averaging about 81 mm.; bill at front, 17 to 20 mm.

The weights of freshly-killed wild birds sent to me from Kashmir were given as 4, 4½ and 4¾ lbs.

Adult Female.—Above, pale grey, profusely vermiculated with black and with black patches on the inner secondaries, scapulars, and to lesser extent, on the back. The feathers of these parts have also, here and there, white central streaks or arrow-head markings. On the head and nape the grey is more rufous in tint, and the centre of the crown is a darker, blackish brown, with the feathers white centred. Tail vermiculated grey and blackish with a broad sub-terminal band of black on all but the central feathers.

Below finally vermiculated grey and dark brown, the feathers of the chin, throat and sides of the head with pale fulvous centres, and those of the breast and abdomen with spatulate white centres bordered by black.

The whole appearance of the bird is grey instead of rufous-brown, as in *satyra*, but the depth of colour varies considerably; in some the black markings on the upper plumage are sufficiently pronounced to make the general tint a rather rich brown-grey, whilst in others it is comparatively pale and dull. The under plumage also varies a good deal, some birds being much darker than others. A few females have the hind nape sufficiently rufous to cause this part to contrast faintly with the rest of the plumage.

Colours of Soft Parts.—As in the male, but the legs without the reddish tinge at any time of the year.

Measurements.—" Length 24; expanse 32; wing 10; tail 9″ : (Hume).

The measurements of 14 females are: wing, 225 to 250 mm. average, 235 mm.; tail, 178 to 190 mm., one very short tailed bird having it only 159 mm. average 184·5 mm.; tarsus, 62 to 75 mm. average 70 mm. ; bill at front, 17 to 19 mm.; weight 3 to 3½ lbs.

The Young Male is similar to the female in his first plumage, but the marks below are rounder, more ocelli in shape and less spatulate.

After the first moult the males assume a blackish crown, the ear-coverts become blackish with white centres, chin and throat sooty-black, and the ocelli appear on the upper plumage here and there and below the white black-edged ocelli are numerous, one or two almost wholly black feathers showing on the heart and flanks.

A certain amount of red is always assumed at this moult, in some specimens practically the whole neck, fore neck and extreme upper breast becomes a deep crimson brick-red, whilst in others this colour is confined to the nape and upper breast.

Distribution.—Apparently the Ganges forms the actual dividing line between this species and the last, but there seems to be a considerable area East and West of this river in which neither is to be found. From the West bank of the Bhagirathi River they extend North and West through Kashmir to Hazara. From the latter country a friend writes :

> "Hume was quite right in saying that the Tragopan occurs here, but they are very rare or else very hard to get at, for I have only seen and shot one, a gorgeous male sunning himself on a high rock, and which I potted without compunction."

Nidification.—The first, and for many years the only, recorded account of this bird's nesting is that of Capt. Lautour, as quoted by Hume :—

> "I was shooting on a range of hills from 8,000 to 11,000 feet high. The Argus in parts very plentiful, the hills covered with pine-forests, and the Argus I used to find about one-fourth of the height of the hills from the top, and they appeared to affect the vicinity and edges of snow nullahs and landslips, where there was a fair quantity of undergrowth, and where there were plenty of rocks.
>
> "At the time of finding the nest, I was on the look-out for Pheasants, but the ground being rather stiff, I had just given up my gun to the *shikari*, when the bird got up almost at my feet. I was going through a pine-forest, and had reached a place where an avalanche or landslip had carried away all the pine-trees, and in their place small bushes and shrubs, resembling the hazel, had sprung up. The nest was on the ground, and was very roughly formed of grass, small sticks and a few feathers ; it was very carelessly built."

The next nest about which I have any definite description was taken by Mr. F. L. Hughes on the 3rd of June, 1908, West of the Makhan Nallah, Chamba. He writes me :—

> "I do not know exactly what the elevation was, but I should say just about 9,000 feet. The nest was placed on a slanting tree, about 10 feet from the ground, in a hollow, where a large branch had been torn off by some storm. It was about a foot in diameter and was composed of a few sticks and grass, the lining being entirely of this material, and contained three eggs, just showing faint signs of incubation. The tree on which the nest was placed was a wild cherry, and was on a steep khud, about 100 feet or so above a stream. The slope was well wooded with the ordinary local trees, chestnut, wild cherry, etc. There was not much undergrowth what there was consisting of elder, as far as I can remember.
>
> "The bird was very shy, and never gave us more than a glimpse, gliding off the nest long before we could get close up to it, however quietly we approached."

In 1910 the nest was again found by Mr. S. L. Whymper on the 6th June. In a letter he says:

> "The only nest I ever saw of the Tragopan, presumably *melanocephalus*, was in the Nila Valley, West of the Bhagirathi in Garhwal. The birds were still about the nest, but this had been plundered by some vermin and deserted; it was quite a respectable loose stick nest with a little grass lining, which had been much disturbed by the plunderer. It was placed under the protection of a small bush growing in an open glade in very dense Ringal Jungle on a steep and rocky hillside.
>
> "The fragments of eggs, in one case practically half an egg, scattered round the nest agree fairly well with Hume's description."

Finally, Beebe found a nest in Native Garhwal which also was built on a tree, but unfortunately he omits to state at what height from the ground. In this case the nest was evidently that of some other bird, probably a crow of some kind, according to Beebe, but had been relined and renovated by the Tragopans. It was a big bulky affair, but well concealed in a tree with dense foliage and many creepers. The nest itself was formed of sticks and grass, evidently placed in position early that year, and was lined again by the Tragopan with fresh twigs, oak leaves and grass.

Two eggs sent me from Pir Panjab, Kashmir, taken in June, 1901, are said to have been taken from a stick nest in a tree.

The eggs differ from the those of *Tragopan satyra* in being much paler and much less round in shape; they also average a good deal bigger. The four eggs in the British Museum collection taken by Capt. Lautour, and a fifth from the same clutch in my own collection and the eggs taken by Mr. Hughes are all a very pale stone-buff, freckled and mottled all over with a dirty pale grey or lilac-brown, making the eggs look very dull. The two eggs taken in Pir Panjab and sent to me are very similar, but have the freckles and mottlings so pale that unless examined closely, they are hardly noticeable; and the eggs in the Calcutta Museum from the same place are much the same. The texture is similar to that of a hen's egg, but without any gloss whatsoever, and decidedly more fragile. In shape they are long ovals, in all but one specimen distinctly pointed at the smaller end.

The breeding season commences, judging from the scanty information available, in the middle of May, and extends to the end of June. Beebe, who omits dates in so many notes in his valuable work, does not say when he found his nest, but judging from the context which gives the names of other birds breeding and of flowers in flower, it was in early May.

This Tragopan is monogamous, like the others of its genus, and appears to be a good father and husband, assisting to look after the chicks when hatched, and remaining with his family until the following spring. These family parties usually number from 4 to 6, showing that it is unusual for large clutches of eggs to be taken, and, though one cannot yet state anything definite in this respect, it will probably be found that 2 to 4 eggs form a normal clutch.

The display of the Western Tragopan is similar to that of the Crimson Tragopan already described.

General habits.—The Western Tragopan keeps to much the same altitudes as its more Eastern brothers, *i.e.*, generally between 8,000 and 10,000 feet, wandering up to 12,000 feet in summer and down to 6,000 feet and even lower in winter. It is still common in many parts of Kashmir despite what Beebe says to the contrary, and equally so in many suitable parts of Native Garhwal, but the bird is so shy and such an inveterate skulker, that it appears more rare than it really is. The fact also that it selects for its haunts almost impenetrable forest and undergrowth growing in the roughest and most broken hills and mountains makes it difficult to find even when one knows that it is somewhere near, and even if found, it by no means infers that it must be brought to bag.

Mr. C. H. Donald writes to me about this bird and its present day habitat and habits:

> "This Tragopan is to be found pretty well throughout the Himalayas in suitable localities, from Kashmir to Garhwal, and is not rare, provided one looks for it in the right place at the right season of the year, and is willing to undertake really hard work and hard climbing in pursuit of it.
>
> "I have shot it as low down as 4,000 feet in winter, but I do not think it often comes much below 6,000 feet. In the summer the forests of oak, spruce, silver fir, etc., especially where more or less mixed with ringal bamboo are its favourite haunts, and it is particularly partial to broken and boulder-strewn country. In winter when it is driven low down by heavy snow, it affects the boulder-strewn forests more than ever. Higher up, the stunted rhododendron and birches which form a dense low scrub on the edge of the Alpine pastures are also much affected by this bird in the early autumn, though they seem to wander into the open parts very rarely, if at all.
>
> "Their flight is unmistakable, and a Tragopan rising suddenly, even though invisible, cannot be mistaken for anything else from the terrific deep whirr its wings make.
>
> "It, however, nearly always prefers running to flying, and when disturbed, will race up a hillside, giving vent to a plaintive, single note, call. A dog approaching one from below will almost invariably have the effect of sending it up

into a tree, where it will sit very close, in amongst the thicker leaves and branches, and may or may not utter its call. Flying from its perch when the sportsman gets closer than it thinks safe, the Tragopan gives an exceedingly difficult shot as, like the Koklas, it goes off with its usual loud whirr, and seems to acquire tremendous pace almost from the moment it leaves the tree. As a matter of fact, I do not think it can really be anything like as fast as the Koklas on the wing in spite of its appearance to the contrary, as I have seen one easily overhauled by a Golden Eagle (*A. chrysaetus*), whereas a Koklas can as easily out-pace the latter, for though I have seen many a long chase of these Pheasants by Golden Eagles, I have never seen one caught, and so long as it can take refuge in forest country, it is safe.

"The Hen Bird is much more prone than the Cock Bird to sit close when taking refuge in a tree on being flushed, and they are very difficult to see when thus hiding. I have spent as much as ten minutes looking for one in amongst the dense foliage, and finally have had to dislodge her with stones, and even then she only took to wing after some dozens had been thrown, and one had nearly hit her.

"The Tragopan is very seldom found in open country and I have not even seen them come out into the open glades in the forest so beloved by the Monal and Koklas.

"The call when disturbed sounds something like wank, wank, wank, uttered at intervals of a second or so.

"As a table delicacy the young bird is hard to beat, and the Tragopan, take him all round, is as handsome as he is sporting, and as sporting as he is good to eat."

They are mainly, but not entirely, vegetable eaters. Principally they live on roots, buds and shoots, and dig deep and wide for the first named, and for bulbs, etc. They sometimes, at all events, eat grubs, beetles and similar food, but there are very few actual records of anything but vegetarian food having been found in their stomachs.

Their call has been described to me as a cross between the "honk" of a wild goose and the "mi-ao" of a peacock. This is exactly how I have myself described the trumpet challenge of Blyth's Tragopan, which is a very fine ringing cry which carries far, even in very dense forest.

TRAGOPAN BLYTHI.

The Grey-Bellied Horned Pheasant.

Ceriornis temmincki.—Jerd. (née Gray), Ibis, 1870, p. 147 (Upper Assam); Newton, Ibis, 1870, p. 520.

Ceriornis blythi.—Jerdon, Pr. As. Soc. Bengal, 1870, p. 60 (Assam), Sclater, P.Z.S. 1870, pp. 163, 219, pl. 15; id. Ibis, 1870, p. 520; Gould

B. Asia. vii. pl. 47 (1872); Elliot, Monog. Phas. 1, pl. 26 (1872); Godwin Austen, P.Z.S., 1872, p. 496 (Naga Hills); id. J.A.S.B., XI iii. pt. 2, p. 172; Hume, Str. Feath., vii. p. 472 (1878), (Descr. of adult and juv.); Hume and Marsh., Game-B. Ind. 1, p. 151, pl. (1878); Godwin-Austen, Ibis, 1878, p. 206 (Mozemah); id. P.Z.S. 1879, p. 457, pl. xxxix.; Cran, Str. Feath. x. p. 524 (1883); Sclater, P.Z.S., 1884, p. 477; Hume; Str. Feath xi. p. 301 (1888), (N. E. Manipur).

Tragopan blythi.—Ogilvie-Grant, Cat. Birds B. M., xxii. p. 276 (1893); id. Hand.-l Game-B. 1, p. 228 (1895); Oates, Man. Game-B 1, p. 254 (1898); Blanf., Faun. Brit. Ind., iv. p. 102 (1898); Stuart Baker, J. Bomb. N. H. Soc. xii. p. 487 (1899); (North Cachar); Ghigi, Rend. Acc. Bologna (5) x. pp. 403, 404 (1903); Beebe, Zoologica, i. No. 15, p. 270 (1914); id. Pheasants, i. p. 78, 1918; Oates, Cat. Birds' Eggs, B. M., iv. pl. v. fig. 5 (1901): Venning, J. Bomb. N. H. Soc. xxi. p. 632 (1912), (Fort White Chin Hills).

Tragopan blythi blythi.—Baker, Bull. B. O. C. xxxv. p. 18, 1914.

VERNACULAR NAMES.—Hur-haria (*Assamese* and *Mikir*); *Sun-sorai* (*Assamese*); Gnu (*Angami Naga*); Aghah (*Sema Naga*); Aogho (*Chang Naga*); Chingtho (*Kuki*).

Description—Adult Male.—Forehead, crown, breast, a patch down either side of the neck and feathers surrounding the bare facial and gular skin black; broad supercilia, nape and occiput, remainder of neck, extreme upper back, shoulders of wing and upper breast crimson Indian red, occasionally with a trace of orange. Upper plumage black, each feather with numerous semi-concentric bars of buff, a terminal ocellus of white surrounded with olive-brown and black, and two sub-terminal ocelli of deep maroon red, surrounded in the same way as the white. The basal mottlings of black and buff are almost entirely concealed, so that the upper plumage appears to be a mass of the white and maroon ocelli. The longest upper tail-coverts are whitish with narrow edges of olive-brown, next to these are black bars and then still broader ones of red-brown fading into the white. Tail black, the feathers with irregular broken bars of rich buff on the basal thirds.

Shoulders of wing crimson-red; bastard wing light brick-red on the outer, mottled with black on the inner webs; wing-coverts like the back; primaries and outer secondaries brownish black with broken buff bars, obsolete on the inner webs of the primaries.

Lower breast and abdomen smoky grey, the centres paler and showing up fairly distinctly against the rather darker margins. The flanks and thighs with black and buff mottlings and these parts with vent, and sometimes the under tail-coverts, are splashed with crimson-red.

Colours of the soft parts.—Iris hazel-brown; bill dark horny, commissure and gape paler, and tinged with fleshy; legs dull reddish or yellow-brown, becoming brighter and redder in the breeding season; horns bright pale Prussian blue, rarely with a verdigris green tinge; lappet orange-yellow or yellow, palest and most yellow on the lower portion, more orange, and also mottled with red on the upper part, and on the orbital skin and cheeks; on the bottom and also half-way up the sides there is a pale blue edging, blue veinings running in from the edge towards the centre.

The colouration of lappets and horns probably differs very greatly individually, two cock birds which I kept alive for some time in a large aviary were quite unlike one another, although brothers. One had the lappet when fully extended orange almost throughout, whereas the other bird had it a pale lemon-yellow with a very broad edging of blue.

"Irides deep brown; orbital skin orange; horns azure; lappets brimstone, tinged with blue; legs and feet light brown, tinged pink" (Damant).

Measurements.—Wing, 260 to 265 mm.; tail, 180 to 220 mm.; tarsus, 82 to 94 mm.; bill about 16 mm. The horns in the breeding season measure a full inch or 26 mm., and the lappet nearly 3 inches or 75 mm. long, by about 36 mm. broad.

Hume gives the total length as 21·0 to 23·0 inches; bill from gape, 1·3 to 1·4.

Adult Female.—Whole upper plumage black and rufous, the black being in broad bold bars and patches, the rufous in narrow bars and minute stippling; in addition nearly all the feathers have a V-shaped or crescentic central mark of buff, a few feathers having two such marks and others longitudinal marks of the same colour. The tail is lighter in general effect, and has the black replaced to a great extent by rich rufous; chin and throat white with brown spots, the former almost immaculate; whole lower surface and flanks mottled and stippled with very dark brown, dull rufous and greyish white, the latter colour forming distinct spots on many of the feathers; the centre of the abdomen and vent are more greyish and uniform in colour, the under tail-coverts rather more richly and deeply coloured.

Colours of soft parts.—Irides pale bluish brown to dark brown: the former colour being almost certainly a sign of immaturity; bill dark horny, commissure, gape and base of lower mandible paler; legs dull fleshy horny, claws darker and browner.

Measurements.—Wing, 230 to 245 mm.; tail, 155 to 180 mm.; tarsus, about 70 mm. (68 to 73 mm.); bill front about 14-15 mm.

Young male.—Like the female, changing in the spring to a plumage half-way between that of the adult male and female.

A fine young male which I had in my aviaries in North Cachar moulted in April-May into the plumage described below.

Forehead to nape deep glossy black; lores covered with feathers, white near the eye, black, edged with reddish next the forehead; a broad supercilium from above the eye red; nape and hind-neck vermiculated brown and black; a broad band from behind the eye and below the supercilium black; ear-coverts dark brown with a few white specks; chin and throat thinly covered with mottled white and brown feathers; lower throat and upper breast as in the adult male; lower breast and under plumage like that of the female, but with many feathers having their centres more or less grey; the upper plumage is like that of the female, but darker and more boldly speckled, many of the feathers of the scapulars and interscapulars, having dull chestnut-brown eyes and similar eyes scattered here and there over the whole of the upper surface.

Irides dark brown; legs dull reddish, the rudimentary spurs paler; gular skin dull orange, showing through the feathers; round the lids of the eye livid, and livid fleshy above the eye; bill horny, culmen darker, and base and commissure pale and rather fleshy.

Distribution.—This fine Tragopan is found throughout the hills South of the Brahmapootra, extending from the Barail Range in North Cachar and the Naga Hills Eastwards throughout the Patkoi Range into North-West Burma and South-Eastwards through Manipur into the Chin Hills, where it is comparatively common in certain suitable places. It is restricted to elevations between 5,000 feet and 9,000 feet.

The specimen obtained by Dr. Cran from the Dapla Hills was undoubtedly the Northern race of this species, which probably connects geographically with the Southern form somewhere in the hills to the East of Sadiya. Beebe's distribution map of the Tragopans does not give this species sufficient range to the North and East.

Nidification.—There is practically nothing on record about the breeding of this Tragopan beyond what is contained in the notes furnished by me to Beebe.

The Breeding Season commences in early April and lasts through May, but probably all chicks have hatched off before June; they are thus, as might be expected from the fact of their lower habitat, earlier breeders than the other Tragopans. The Angami Nagas, who know these birds well, assure me that they *always* lay their eggs in nests in trees, stumps, or even dense thick bushes, but never actually on the ground. Most often the nests are placed at a height of 6 to 10 feet from the ground, but more rarely as high as 20 or 25 feet. According to most Nagas, the birds build the whole nest themselves, but one of my informants, shrewder than the rest, said that the birds usurped other birds' nests and then finished them off according to their own taste with additional sticks, twigs, leaves and grass. This man also told me that he had taken a nest which was merely a platform of sticks and twigs placed on the top of a mass of leaves and vegetable rubbish collected in the creepers covering an old tree.

Certainly my own birds in captivity made determined efforts to lay their eggs on their perches in the aviaries, a feat of balancing quite beyond their powers. The first egg laid was found by me in a pail of water *under a perch*, though unfortunately this fact taught me nothing; when, however, two more were found, smashed, directly underneath the same perch, light dawned on me, and I fixed up a suitable box on the perch which was at once adopted by the Tragopan, and the fourth egg duly deposited therein. Another egg was laid by another hen in a box fixed about 8 feet from the ground in the top of the aviary, although there were other boxes on the ground, had the birds cared to avail themselves of them.

The natives say they lay from 2 to 5 eggs, generally only 3 or 4, but that they never succeed in hatching and bringing up more than two young ones. They also say that the young are quite capable of getting down from the nest to the ground directly they are hatched, and that they can fly well within a week.

The cock bird's method of display in a wild state is given further on in this article, but I had many opportunities of observing partial displays of my tame birds. The most noticeable thing was the curious way these Tragopans had—like all the rest of the genus—of suddenly shaking their heads violently, and at the same time inflating horns and wattle, giving the on-looker the impression that the shake released some automatic spring which released the horns, &c. This action was sometimes performed by the bird when perched, in which case he generally erected himself as much as possible—stood on his toes, more or less, or on the ground when he crouched low down. In either case the action was often accompanied by a shivering of the wings, and sometimes led to a partial display never completed, as it was always interrupted by some other male bird interfering. I noticed the cocks in half plumage began this display at least a dozen times to the older bird's once.

The only eggs which have been recorded are the three above referred to, one in the British Museum and one in the Tring Museum, both the latter also laid in captivity.

In shape four of the eggs are broad ovals very little compressed at the smaller end, and the fifth, that in the British Museum Collection, is a rather narrow oval. The five eggs measure, respectively, 59·7 × 42·6 mm.; 57·8 × 45·4 mm.; 58·6 × 43·7 mm.; 59·0 × 42·8 mm. and 60·9 × 36·5 mm.

The texture is close and smooth, with a very fine, rather soft grain, but practically no gloss.

The colour is a pale dull buff obsoletely speckled, and freckled with chocolate. Both my eggs are much claw-marked and scratched by the birds in getting in and out of the nest. The eggs are exactly similar to those of *melanocephalus* in colour and texture, and like them much paler than those of *satyra*.

General habits.—This bird lives at an altitude considerably lower than that generally affected by this genus; 9,000 feet forms its upper limit over the greater part of the Barail Range, but it doubtless wanders higher in the Eastern Naga Hills, and the higher peaks of the Patkoi Range. On the other hand, it is constantly found as low down as 5,000 feet even in summer, and round Fort White in the Chin Hills is common at this elevation.

As far as I can ascertain. it does *not* move up and down the hills in summer and winter, but is more or less resident at the same elevation throughout the year. This is doubtless due to the fact that nowhere except in the extreme North-East are the hills it frequents high enough to come within snow limits.

It is a bird which keeps much to dense forest and prefers such as has thick undergrowth and is of a broken rocky nature. Over most of its range it is of a very shy retiring nature, but Venning records that in the Chin Hills it is so bold and so stupid that an officer was able to knock one over with a stone after he had had several shots at it.

The first occasion on which I ever saw this grand Game-bird was described by me in Beebe's "Pheasants", and so little is known of it that I venture to quote this again in full:—

> "Although common in parts of the Naga Hill's Ranges. at elevations over 6,000 feet, Blyth's Tragopan is but a rare straggler into the adjoining ranges of North Cachar, and it was, therefore, some years after I was first posted to that district before I came across it in a wild state.
>
> "When at last I did see it, the meeting was most unexpected, for at the time I had no idea that this magnificent pheasant ever wandered so low as 6,000 feet, the elevation at which I was then camping.
>
> "The country surrounding my camp was of a very broken and rugged character; the main range of hills, known as the Barail Range, running almost due North-East and South-West, and having on either side two rapidly flowing hill streams, to the West the Jennam and to the East the Jiri. These streams, though full of Mahseer, and magnificent from an Isaac-Waltonian point of view, were too small, except in their lower reaches, during the cold season, even for the use of dug-outs. In the rains, on the other hand, they formed mad torrents of muddy water, hurling themselves from rock to rock in a blinding spray of yellow foam; or pouring themselves in a headlong tumult over broken rapids or actual water-falls. Far above these streams which in the distance look like silver ribbons, towered the crests of Mahadeo, Hengmai, Hungrum, and other mountain peaks, narrow spurs jutting from their sides and running down into the valleys beneath. At the feet of these mountains the

vegetation was most luxurious and massive; magnificent forest trees reared their heads a hundred feet above the scrub and jungle which grew below them, but, as one ascended above 4,000 feet, the vegetation began to get more scanty, and from 5,000 feet upwards, stunted oaks seldom more than 30 feet high, formed the principal part of the forest.

" Even here, however, the jungle was most lovely, for every tree-trunk and every swaying bough was wreathed with masses of moss, amongst which nestled orchids of all kinds and colours. That beautiful scented orchid, the white snowdrop-like *Cœlogyne*, filled the air with its odour, and on every side the *Dendrobium chrysotoxum* and *densiflorum* showed their masses of yellow blossom against the vivid green moss. Nor was the undergrowth unworthy of the rest of the forest. Here and there Jasmine flowered and clambered in wild profusion; here and there were banks of bracken, looking as if imported from some Welsh mountain-side, and everywhere were glades of various begonias with their multi-coloured foliage and flowers, and ferns of all kinds, from the most delicate trailing maidenhair to palm ferns as tall as the oaks around them.

" High up near the crests of one of these mountains ran a tiny rill, tinkling and trickling amongst the pebbles of soil laid bare during heavy rains, until with many others of its merry brethren it lost its identity in the rivers below.

" At the edge of this little streamlet I lay down amongst the moss and ferns prepared to watch whatsoever animal life might decide to show itself.

" Birds of all kinds were numerous and bold, taking little notice of the dull clad human watcher. A bevy of Yellow-throated Minivets flew from tree to tree; the orange and grey males constantly uttering their musical notes, as they flitted along in their follow-my-leader style from one fine field of insect game to another. A pair of Scaly-breasted Wrens bustled about over a fallen log, rather shy at first and resenting my presence with shrill cries, but soon becoming reconciled, and once more busy collecting material for their nest, hanging amongst the moss on a tree near by. Then a flash of transparent pink, yellow and grey, gliding from one tree-trunk to another, told me of the flight of one of the tiny flying lizards, and almost urged me to rise and catch it—if I could—but laziness triumphed and I remained on my mossy bed. I had lain there about an hour, and was almost dozing, lulled by the soft breeze and the hum of cicadae and grasshoppers, when a chuckling call and a scratching among the undergrowth across the stream recalled me to my senses. At first I credited this call to a Horsfield's Kalij Pheasant, though these are rare at this elevation, but presently a richly-coloured brown bird made its way into the open space. This bird, I saw at a glance, was no hen Kalij, for even at the distance it then was, I could see, without using my glasses, that the feathers were marked with broad striae or bands of colour darker than the rest. I had, however, never seen a hen Tragopan, and could not recognise what it was until she was followed by her mate, and a magnificent male specimen of Blyth's Tragopan, resplendent in his crimson glory, burst upon my view.

"For a few minutes the two birds, male and female, scratched about the hillside just like a pair of barn-door fowls, now and then picking up an insect disturbed from under the pebbles, or seizing a grasshopper from the scraps of herbage scattered about over the bare ground. But presently, ceasing to take any interest in the abundant food all about him, the cock bird began to attempt to attract the attention of the hen by all sorts of antics and displays. At first he merely came up to her and bowed and scraped with his wings slightly raised, and his purple-blue horns fully dilated and projecting forward. Then seeing that she took no notice, he depressed his wings and walked slowly round her, nodding violently as he walked, and swelling out his throat and breast, the feathers of which were ruffled and standing almost on end. After a short time of this ineffectual display, he once more stopped in front of the hen, and standing still, leaned forward until his breast almost, or quite, touched the ground; he then extended both his wings, so that their upper portions faced the same way as his head, and stood thus for some seconds—a blaze of deep crimson, with his weirdly shaped horns quivering with excitement, and his wattle displayed to the fullest possible extent. Then suddenly his feathers collapsed, his horns nearly disappeared; he held himself erect, and once more quietly commenced to scratch and feed, until he and his mate shortly disappeared into the adjoining forest.

"As far as I could see, the hen bird took little or no interest in the display of the male, and continued serenely feeding all the time it was going on, but this was perhaps only a lady-like way of inducing him to exert himself to the uttermost. Both birds constantly uttered a soft, chuckling note, and now and then the cock bird gave a loud *quawk*.

"I have had a great many of these birds in confinement, and found them—once they had settled down—very easy to keep. They were almost omnivorous in their diet, and would eat any sort of grain, many kinds of green food, and any insects, small reptiles, etc., which I could procure for them. The males were rather quarrelsome, more especially during the breeding season, but they seldom did one another much harm, the weaker bird promptly apologising and retiring to a distant part of the aviary, whilst the stronger was quite content to strut around, and proclaim in loud *quawks* what he would have done had it ever come to a fight.

"The cocks had a magnificent loud clanging, almost trumpet-like call which they uttered only at daybreak during the breeding season; it was rather like a mild and musical call of a Peafowl, but shorter and not nearly so harsh.

"The Nagas, especially the Angamis, are adepts at catching these Tragopans in nooses, and on one occasion I had no less than 30 of these beautiful birds brought to me."

Mr. J. P. Mills, of the Indian Civil Service, sends me the following interesting notes on this Tragopan from Mokokchung in the Naga Hills:—

"This Tragopan inhabits evergreen forest at about 6,000 feet and over, going about in the non-breeding season, in small parties which may number as many as four or five. The call in unmistakable, sounding something between a bleat and a loud "mi-a-ou." It runs well but does not readily fly. Its diet consists largely of flies, small leaves and shoots and one which I had in captivity could only be induced to eat mustard leaves (the stuff Goorkhas call *lai-patta*, which I expect you know). It stands captivity very badly and soon loses condition, even if it does not die of shock within an hour or two of being caught.

"The Sema Nagas call it "*aghah*" and the Chang Nagas "Aogho" which means "The foolish bird." Certainly, it seems to act up to its name for the Changs catch it as follows: A man goes through a likely piece of jungle chopping occasionally at a tree with his dao as he wanders along. If a Tragopan is anywhere near it promptly replies to the sound, for it is their custom to call whenever they hear any unusual sound. The man then chops lumps of bark and wood of the tree and arranges snares in a circle all round it. Flies promptly comes in numbers to suck up the fresh sap and the Tragopans are attracted in trees by the flies, and in attempting to catch them are themselves caught in the nooses. Tragopans are very conservative in keeping regularly to certain runs in the forest, and both Semas and Changs take advantage of this to noose them in the runnings they most frequent."

TRAGOPAN BLYTHI MOLESWORTHI.

The Tibetan Tragopan.

Tragopan blythi molesworthi—Stuart Baker, Bull. B.O.C., xxxv. p. 18 (1914) (Tibet). Bailey, Journal, B. N. H. Soc., xxiv. p. 76 (1915) (Tse-La Tawang). Beebe, Pheasants, i. p. 86 (1919).

Tragopan blythi—Cran, Str. Feath., x. p. 524.

VERNACULAR NAME—Bop (Tibetan).

Description—Adult Male.—Differs from *Tragopan blythi blythi* in having the whole upper parts much darker in general tint, the rufous spots much browner and the buff vermiculations narrower and less distinct; the white spots are smaller, though equally numerous. Below, the red of the breast is confined to a comparatively narrow gorget, descending only a short way below the neck on to the breast, and the whole of the rest of the lower parts are much paler than in *Tragopan blythi blythi*, the pale centres of the feathers hardly showing at all in contrast with the surrounding parts.

Both legs show powerful, but blunt short spurs, about 10 mm. in length.

Total length about 530 mm.; wing, 250 mm.; tail, 195 mm.; tarsus, 76 mm.; middle toe and claw, the same; bill from front about 19 mm.

Female—Unknown.

Distribution.—The type of this sub-species was obtained by Capt. Molesworth, after whom it is named, at the Tse-La, Tawang, Tibet, in the mountains due North of the Dibrugarh District of Assam, rather further East than the point shown in Beebe's map of the Tragopan's distribution.

It is probable that it extends along the mountains at from 6,000 to 10,000 or 12,000 feet, from Bhutan to the Brahmapootra on the East, forming a Northern race of *blythi*, and divided from it on the South and East by that river. The bird obtained by Cran from the Dafla Hills and recorded in "Stray Feathers" must have been this sub-species, and officers and others of the Mishmi Expeditions of 1911-12 frequently came across a Tragopan which must also have been the same.

Nidification.—Nothing known.

General Habits.—As far as we know at present, the Tibetan Tragopan inhabits much the same country and forest as its nearest relations. Molesworth obtained it at about 8,000 feet, and in the Mishmi Hills it was seen at about 9,000 to 10,000 feet on several occasions. It is, perhaps, a bird of higher altitudes than the Grey-bellied Tragopan, for the Abors told me that it never came below a ridge of hills running well over 7,000 feet, and they said that Sclater's Monal and this Tragopan inhabited the same forests and the one came no lower down than the other.

Colonel J. Chatterton came across them more than once, and told me that though they kept to the thickest undergrowth, and were very hard to get a glimpse of, they were not shy, but would continue to feed and scratch about within a few yards of one almost immediately after they had been first disturbed.

TRAGOPAN TEMMINCKI.

Temminck's Tragopan.

Satyra temminckii,—J. C. Gray, Ill. Ind. Zool. i., pl. 50 (1830-32).

Tragopan temmincki,—Benn. P.Z.S. 1834, p. 33. Ogilvie-Grant, Cat. Birds B. M., xxii. p. 275 (1893) ; id. Hand-B. Game-B. 1, p. 227 (1895) ; Oates, Man. Game-B. 1, p. 251 (1898) ; id. Cat. Eggs B. M. 1, p. 51 (1901) ; Ghigi Rend. Acc. Bologna (5), x. pp. 403-404 (1903) ; St. Quinten, Avicult Mag. new series 1, p. 95 (1903); id. iv. pp. 192, 284 (1906) ; Baker, J. B. N. H. Soc., xviii. p. 753 (1908) (Sadone Hill Tracts, Pansong Pass), Oates, J. B. H. N. Soc., xix. p. 260 (1909) (Sadone). Ingram, Nov. Zool., xix. p. 270 (1912) (Yunnan). Thayer and Bangs, Mem. Comp. Zool. Harvard Coll., xl. No. 4, p. 140 (1912); Fangshen, Hupeh and Washan (W. Szechuen). Bailey, J. B. N. H. Soc., xxiv. p. 76 (1915) (S. Tibet).

Ceriornis temmincki,—Gray, Gen. B. iii. p. 499 (1845). Blyth, Cat. Mus. Asiat. Soc. p. 240 (1849); Swinh., P.Z.S., 1863, p. 307. Sclater, List. Phas. p. 11, pl. 11. (1863) (China). Gould, B. Asia, vii. pl. 46 (1869). Sclater, P.Z.S., 1870, p. 164 (N. and E. Szechuen to C. China). David., N. Arch. Mus. Bull. vii. p. 11 (1871) (Szechuen). Swinh., P. Z. S., 1871, p. 399 (W. China). Elliot, Mon. Phas. 1, pl. 24 (1872). David, and Oustal. Ois Chine, p. 118, pl. 112 (1877) (S. W. China to S. Shensi); Hume. Str. Feath. viii. p. 201 (1879) (Mishmi Hills). Sclater, P.Z.S., 1879, p. 117, pl. viii. fig. 3. Seebohm, Ibis, 1891, p. 379 (W. Szechuen) Gurney. Ibis, 1899, p. 40. Beebe Pheasants, i. p. 87 (1819).

VERNACULAR NAMES.—Bop. (*Tibetan*); Oua-Oua-ky ; *Ko-ky ; Kiao-ky ; Sin-tsiou-ky ; Tso-che (*Chinese*).

Description—Adult Male.—Forehead, lores, anterior crest, ear-coverts and sides of head, and feathers surrounding bare gular skin black. Posterior crest and centre of crown and nape, neck, extreme upper back and upper breast deep orange red, changing into crimson maroon or maroon-red on back, rump and upper shorter tail-coverts. These latter parts with ocelli of pure grey surrounded with black ; longer tail-coverts dull pale red, the centres paler and greyish, and the tips darker and more richly red. All the feathers from upper back to the longest tail-coverts have the bases mottled blackish brown and buff, showing through the maroon here and there where the feathers are disarranged. Tail buff, with broad, deep brown bar at end, and with numerous narrower bars and mottlings of the same ; a rufous tinge is also present on the buff in most cases.

Wing-coverts like the back, but with larger ocelli ; edge of wing and bastard wing light brick-red ; quills brown, barred and mottled, especially on the outer webs with rufous, changing to pale buff on the secondaries ; on the innermost secondaries there are ocelli, like those on the wing-coverts, but larger and more ill-defined ; there is also a certain amount of red splashing.

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* The translation of these names are roughly : Jungle-fowl, Horned-fowl, starred-fowl, and Long-life-fowl.

Below the orange-red of the foreneck changes into Indian red again paling on the posterior flanks and thighs and under tail-coverts, whilst the vent and centre of the abdomen is an almost yellowish red. The whole of the under surface feathers have their centres grey in clear cut distinct oval markings.

Colours of soft parts.—" Mandibles black, pale towards the tips; fleshy horns, and facial area blue; gular lappet deep purplish blue, with margins and indentations deep salmon; legs and feet pink or reddish, deeper in colour at the breeding season. (Beebe).

" The bird had two horns, each about 1¼-in. long of a light peacock blue colour and a pouch under his throat, 3½ to 4 inches long of the same colour, mottled over with reddish yellow spots, about ¼" in diameter." (W. Scott).

Measurements.—Wing, 225 to 263 mm., average 36 birds, 242 mm.; tail, 185 to 230, average 215 mm.; tarsus 70 to 80 mm.; bill from front about 15 to 16 mm.

Beebe gives the tail as averaging 215 mm., and wing 251 mm.

Weight, 3½ lbs. (Bailey).

Adult Female.—The females vary in general tint, from dark rich grey-brown to a quite bright rufous-brown, and vary in this respect far more—apparently—than the females of any of the other Tragopans.

The whole of the upper parts are mottled with velvety black and dull to bright rufous, whilst on the wing-coverts, scapulars and back there are numerous arrow-shaped marks varying from white or pale grey to bright cream-buff; on the necks the palest markings are obsolete, and on the centre of the crown, which is darker than elsewhere, these central streaks become longitudinal and spatulate in shape. The tail is like the back, but the markings form broken irregular bars.

Below the chin and throat are more or less immaculate and vary from smoky white to a rather rich buff; the front and sides of the neck are buff or rufous, each feather edged with black; the breast is much mottled with black or dark brown and fulvous, the feathers with whitish centres; towards the abdomen the general colour becomes paler, and the white central spots purer white and more definite; the abdomen, vent, thighs and under tail-coverts are the same, but with the mottling, finer, paler and duller.

The range of variation in general tone in the lower parts is quite as great as in the upper, some specimens appearing brown or grey-brown and others quite a bright ferruginous.

Colours of soft parts.—Legs dull pale horny-brown or fleshy-brown; irides dark brown; bill dark brown, paler at tip.

Measurements.—Wing, 220 to 230 mm., average 224 mm.; tail, 180 to 205 mm., average 194 mm.; tarsus, 65 to 74 mm.; bill at front about 14-15 mm.

The Young Male is similar to the female, but according to Beebe, "very rarely do we find an individual clad in the full, dull, female-like plumage, but almost always the head and neck are far ahead of the body plumage. When this full immature garb is attained, we find the head and neck to be clad in dull brown feathers, those of the crown with few or no markings, while the chin and throat are streaked with white. By far the more usual plumage of the first year male is a black crown more or less tinged with brown and dull red. Around the neck as in *melanocephalus* we find a bright collar, dull orange-crimson at the back, and usually orange-yellow across the throat."

The Chick in down.—Lores, crown, bright rufous-brown, changing to darker chestnut-brown on back and tail tuft; circle round eye, sides of neck and ear-coverts brighter pale fulvous rufous; below pale dull fulvous; wing-coverts like the back, quills and greater coverts dark brown, mottled and barred with light rufous and black.

Distribution.—In the extreme West of its range, this form meets and is found in the same area as *Tragopan blythi*, overlapping the true *blythi* in the Chin Hills, and the sub-species *molesworthi* in South-Eastern Tibet. Thence it extends through Yunnan and the Kachin Hills, Sadiya, Mishmi Hills and the Tibetan Mountains Northwards through Ta-tsien-lu, Szechuan, Shensi, Hupeh, as far East as the Mountains North-East of Hankow.

The distribution as given by Beebe requires considerable extension to the North-West, North of the Brahmapootra River.

Major F. M. Bailey records it as common on the Upper Dibang Valley and the Tsanpo Valley.

Mr. W. Scott was the first person to find this handsome bird within our limits, obtaining a skin at Sadone. Since then numerous other specimens have been obtained in Yunnan and in the hills and mountains bordering Assam on the North.

Nidification.—There is practically nothing on record about the breeding of this bird in a state of nature. There are 6 eggs in the British Museum from Ta-tsien-lu, said to be a single clutch, though they look more like two, and any number of eggs laid in captivity. I have also 3 eggs, a complete clutch, of well-incubated eggs obtained through Schluter from some French missionaries taken at Shensi, Peling Mountain. These were taken on the 23rd May 1891, I am informed, from a stick nest in a fir-tree, but I have been unable to elicit any further details.

Judging from its breeding in captivity, the season commences in April, and lasts through May into early June, and the usual number of eggs laid is 2 or 3, the former more often than the latter. As with all other birds, a hen may be induced to lay a large number of eggs if they are taken away as soon as laid, but this means nothing.

The breeding area seems to be at an elevation between 7,000 and 10,000 feet, and the type of country much the same as that frequented by other birds of this genus. The period of incubation is said to be 27 days.

As this is by far the most common of all the Tragopans in captivity, there is a great deal on record about the displays indulged in by the cock during the breeding season. The many descriptions are well summarised by Beebe, who writes:

> " As the breeding season approaches and the loud challenge cries have remained unanswered, the cock commences actual display. The principal preliminary overtures may be described as follows :—
>
> 1. " A slow stately walk about the female, the wing toward her lowered and partly spread, the shoulder on the further side raised, the body being thus flattened, with much of the upper plumage in view.
>
> 2. " A sudden rush with partly spread wings, with or without the erecting of the horns, or the wattle or both.
>
> 3. " In the *tout-ensemble* of the climax, the bird suddenly ceases its stately gait, the plumage of most of the lower parts is fluffed out; the half-spread, drooping wings move slowly, with wrist edges well out from the body and tips pressed inwards and downwards; the head and neck vibrating spasmodically, until the horns and wattle flash out to their utmost. This last touch gives to the Tragopan an indescribable appearance; from beautiful it becomes gaudy; from an excited half-crouching bird it changes to a grotesque, painted creature, and before one knows whether to admire or merely marvel, the moment has passed, the horns and wattle contract, the feathers settle, and after a moment the Tragopan walks off."

The eggs are in texture, shape and colour like those of *T. blythi*, but are duller, dirtier-looking eggs, paler in the ground colour and more distinctly mottled and blotched or spotted with dingy yellowish brown and dull violet. The number of blotches, &c., vary considerably, in one they are practically absent, in most rather numerous, whilst in some they run into one another and cover most of the egg.

My 3 wild-laid eggs measure 54·1 × 41·4 mm.; 53·6 × 40·8 mm.; 53·4 × 40·7 mm. respectively.

17 eggs in the British and Tring Museum laid in captivity and 12 others I have been able to examine, measure in length between 50·5 × 40·5 and 57·1 × 41·1 mm., and in breadth between 52·6 × 35·8 and 55·2 × 41·8 mm.

Beebe records an egg only 37 mm. in breadth and his other measurements also fall within the limits given above.

General Habits.—Père David records that this Tragopan "lives a solitary life in the wooded mountains, seldom leaving the thick cover, and feeding on seeds, fruits and leaves. Its cry is very loud, and most nearly imitated by the syllable *oua* two or three times repeated, whence its Chinese name *Oua-oua-ky*, but it is also called Ko-ky, or Kiao-ky, meaning Horned-Fowl, and Sin-tsiou-ky, or Starred-Fowl, on account of the grey spots adorning the plumage. The flesh is said to be capital eating. I am informed that this bird is not met with under about 10,000 feet above the sea level."

E. H. Wilson, in his most interesting book, "A Naturalist in Western China", writes:

"This strikingly handsome bird is fairly common in parts of Western Hupeh and Western Szechuan, between 4,000 and 9,000 feet altitude, frequenting woods and shrub-clad country. It prefers steep mountain slopes, covered with aborescent vegetation, and in summer, when the foliage is on the trees, is most difficult to find. In winter it may occasionally be surprised, early in the morning or evening near the margins of cultivation and close to thick cover. Like all the woodland pheasants, these birds will only take wing when hard pressed and usually afford only a chance snapshot. A heavy bird, the Tragopan flies almost at the speed of an ordinary pheasant, and always makes straight for dense brush or timber. The Chinese entrap them alive in the same way they do the Golden and Amherst Pheasants. They are esteemed highly as pets, and they sell for from 3 to 5 ounces of silver each,—a high price in these regions. The markings on the wattle are supposed to resemble the Chinese character for longevity, hence the common name Tso-chi. They are regarded as birds of good omen, bringing good luck and long life to their fortunate owners. Every year numbers are brought down to Ichang for sale, where they find ready purchasers. In the mountains they apparently adapt themselves to captivity but in the Yangtze Valley proper the climate is too hot for them.

"The short tail and heavy body make the birds appear heavy in flight, and shooting them would be moderately easy did one but get fair chances. The Tragopan is a good table bird, but to shoot them for this purpose alone would be gross scandalism. They feed on grain and berries, and are especially fond of the fruits of the Cotoneaster and allied shrubs, and of maize. South of Ichang this bird is much rarer than in the mountains North-West of this town, and in Western Szechuan."

In Yunnan Beebe found them in what he calls most uninteresting country, the forest being stunted Rhododendron mixed with bamboo stubble.

The crop of a bird examined by him was full of vegetable matter—apparently shoots and buds—and insects, amongst which latter two spiders were recognisable.

TRAGOPAN CABOTI.

Cabot's Tragopan.

Ceriornis caboti.—Gould, P.Z.S., 1857, p. 161 (China); id. Birds As. ii-vii. p. 48 (1858); Swinh., P.Z.S., 1863, p. 307; Sclat., List. of Phas., p. 11. (1863) (? China); Swinh., Ibis, 1865, p. 350 (Hills of Quang-si ?); Sclat P.Z.S., 1870, p. 164; Swinh., P.Z.S., 1871, p. 399; Salvad., P.Z.S. 1871, p. 695; Elliot, Mon. Phas. I pl. 25 (1872); David and Oustal. Ois. Chine, p. 419, pl. iii., 1877 (Mts. between Fokien and Kiang-si); Rickett and La Touche, Ibis, 1898, p. 333 (Fohkien); La Touche, Ibis, 1899, p. 49 (Fohkien); Rickett, Ibis, 1900, p. 59 (Fohkien); La Touche and Rickett, Ibis, 1905 p. 58 (Fohkien); Touche, Ibis, 1913, p. 281 (Description of Nestling).

Ceriornis modestus.—David, M.S., David and Oustal., Ois. Chine, p. 419 (1877).

Tragopan caboti.—Ogilvie-Grant, Cat. Birds B.M. ii.-xxii. p. 277 (1893) id. Hand-B Game-B. 1, p. 229 (1895); La Touche, Ibis, 1900, pp. 29-30 (Eggs described and colours of soft parts of male and female); St. Quintin, Avicult. Mag. new series 1, p. 95 (1903) (Incubation in captivity); Ghigi, Rend. Acc. Bologna (5) x. p. 402. tav. ii. (1903); Beebe, Pheasants, i. p. 99 (1919).

VERNACULAR NAME—Tu-shou-chi (*Chinese*).

(*To be continued.*)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XVIII—(*continued*).

REPORTS ON THE HOUSE RATS OF INDIA, BURMA, AND CEYLON.

BY

MARTIN A. C. HINTON.

PART IV.

(*Continued from page 725 of this Volume.*)

TABLE I (*i*).—Measurements of Skulls of Indian Members of *Rattus rattus* group (in Millimetres)—*contd.*

Dimension No.	*Rattus rattus nemoralis.*						*Rattus rattus alexandrinus.*								*Rattus macmillani.*					
	Ceylon, B. M. 15·3·1.						Sind, B. M. 8·1 22·9–11 & 15·11·1.								Hkamti B. M. 15·5·5.				Taman-the.	Kin.
	·176 ♀	·175 ♂	·173 ♂	·182 ♂	·174 ♀	S. 1 ♂!	·113 ♀	·110 ♂	·112 ♀	·11 ♂	·10 ♀	·9 ♀	·114 ♀	·115 ♂	·226 ♂	·227 ♀	5847 ♂	5975 ♂	6079	5310
Teeth : State of Wear :—	mod.	½	mod.	mod.	mod.	much	mod.	mod.	½	½	½	½	mod.	mod.	mod.	much	mod.	mod.	½	½
1	38·1	40·1	41·7	36·4	37·6	36·8	37	37·6	38	40	39·3	39·5	35·5	37·9	38·3	38·4	35·5	36·7	34·9	36·5
2	..	43·3	44	39·6	40·5	40	39·3	39·4	40·2	41·5	41·4	41·6	37·7	40·5	40·7	41·5	38·2	39·1	37·8	39·1
3	..	..	21·7	18·9	19·3	19·2	19·3	20·5	20·2	21·1	21·4	21	17·6	19·5	19	19·9	18	17·9	17·5	18
4	6	6·4	6·6	6·1	5·8	6·1	5·7	5·6	5·9	5·9	6·2	6·2	5·2	6	5·5	6·1	5·9	5·9	5·2	5·5
5	14·6	15·4	16·8	15·7	16	15·9	15·5	15·2	15·7	16	16·2	16·2	14·4	16·1	16·3	16·5	15·8	15·8	15·3	15·7
6	13·8	14·2	15	14·2	13·8	14·4	13·5	13·6	14·2	14	14·9	14·9	13·1	15·1	14·1	14·4	14	14·2	13·5	14·4
7	11·8	12·2	13·2	13·6	12·6	13·2	11·8	12·5	12·4	12	13·5	13·2	11·1	..	11·1	11·6	12	12·2	11·7	12·8
8	14·3	16·2	17·5	15·2	15·7	15·5	14·7	15·7	15·4	16·1	16·4	15·5	14·1	15·5	15·2	15·3	14·6	14·7	14·5	15·3
9	8·7	9·9	10·1	9·1	9·2	9·4	8·6	9·2	9·2	9·2	9·7	9·3	8·7	9·1	8·8	9·6	9·2	9·1	8·3	9·6
10	17·5	19	20	16·8	18·1	17·3	17·5	18·2	17·7	19·4	18·7	19·1	16·7	18	17·4	17·4	16·1	16·4	15·8	16·5
11	9·8	10·3	11·1	10·2	10·3	9·7	9·7	10·3	9·8	11	10·4	10·4	9·6	10·4	10·3	10	9·4	9·6	9·6	10·4
12	13·7	15·9	15·8	14·3	14·7	14·4	13·4	13·7	13·7	14·8	14·8	14·7	13·5	14·3	15	15·2	13·5	14·2	13·4	14·2
13	4·2	4·4	4·9	4·3	4·1	4·5	3·8	4·5	4·2	4	4·2	4·7	3·8	3·6	4·1	4·4	4·2	4	3·6	4·4
14	22·1	23·2	23·7	21	21·4	21	20·8	21·2	21·9	22·4	22·5	22·5	20·1	21·1	22·3	22·4	20·5	21·6	20·4	20·8
15	10·7	11	12	10	10·2	10·7	9·5	10·1	10·2	11	10·6	11	9·1	10·4	10·7	10·5	9·1	10·2	9·5	9·8
16	7·7	8	7·6	7·4	6·6	7	7·2	7·5	7·2	7·2	8	7·9	6·9	7	7·3	7·7	7·1	7·4	6·9	7·3
17	2·9	3·4	2·9	2·2	2·5	3	2	2·4	2·7	2·7	2·6	2·9	2·1	2·3	2·8	2·2	2·7	2·6	2·3	2·6
18	6·7	7·5	7·8	7	6·8	7·1	6·8	7·1	7·2	7·2	7·9	7·7	6·4	7	6·8	6·7	6·5	6·6	6·2	6·9
19	4	4	4·1	3·9	3·9	3·6	4	3·8	4·2	3·8	4	4	3·7	4·2	4·1	4·4	4·1	4·2	3·8	4·2
20	5·9	6·1	6·1	6	6	5·6	6·2	7·1	7·2	6·2	6·3	5·6	6·4	7	7	6·7	7	6·7	6·2	6·6

TABLE I (*j*).—Measurements of Skulls of Indian Members of *Rattus rattus* group (in Millimetres)—*contd.*

Dimension No.	*Rattus kelaarti.*					*Rattus nitidus nitidus.*														
	Ceylon, B. M. 15·3·1.					Nepal Type.		Kumaon, B. M. 14·7·10.				Sikkim, B. M. 15·9·1.								
	·224 ♀	·218 ♂	·223 ♀		S.1001 ♀	79·11·21·415	3727S. ..	·141 ♀	·146 ♂	·147 ♂	·144 ♀	·163 ♀	·157 ♂	·161 ♀	·229	40 ♂	68 ♀	305 ♀	·149 ♀
Teeth : State of Wear :—	mod.	½	much	½	much	mod.	½	much			much	sl.	mod.	mod.	½	½	½	½	much
1	36·4	36·7	37·1	37·9	36	42*ca.*	41·2	40·5	40·6	40·7	42·6	38·9	40·5	41	42·3	43	42·4	39·1	44·4
2	39.7	40	40·7	41·5	39·2	44*ca.*	43·8	42·5	42·8	42·9	44·7	42	42·6	43·1	45·3	45·3	44·7	41·7	45·5
3	18·7	18·6	18·5	19·3	19	20*ca.*	21·1	20·2	19·7	19·7	21·7	20·6	20·9	20·6	21	21	21·2	19·7	22·3
4	6	5·9	6·1	6·6	5·9	6	6·2	6·3	5·9	6	6·2	6	6	6·2	6·2	6·4	6·6	6·1	6·5
5	15·8	15·9	15·9	15·9	15·8	16·8	16·6	16·2	16	15·7	16·6	15·9	16·9	16·7	17·4	16·8	16·5	16·3	16·5
6	14·1	14·2	13·5	14·1	14	15·4	15	14·8	14·2	14	14·5	14·1	15·5	15·7	16	15·8	14·9	15	15
7	12·3	12·8	12·3	12·1	..	13	..	13·3	12·8	12·8	12·7	12·5	13·5	14	14·3	13·4	13·8	13·2	13·2
8	15	14·9	14·9	15	14·8	16·4	16·5	16·2	16·2	16	16·4	15·8	16·7	16·6	17	17	17·1	16·1	17·1
9	9·4	9·1	8·9	9·1	..	..	10·4	10·2	9·9	9·9	9·9	10	10·1	9·7	10·4	10·5	10·7	9·6	9·5
10	16·9	16·3	17	17·9	16·4	..	19·1	18·1	18·4	18·3	19·6	18	18·9	19	19·6	20·2	19·5	17·4	20·4
11	10	9·5	9·6	10	9·4	..	9·7	10·2	10	10·1	10·9	9·8	10·2	10·6	10·6	10·8	10·8	10·1	11·1
12	14·2	14·2	15·3	15·8	13·9	17·3	18·2	17·2	17·9	18·2	18·7	16·6	17·7	17·9	18·4	18·3	17·6	16·5	17·8
13	4·4	4·1	4·6	4·6	4·2	4·4	4·8	4·2	4·5	4·4	4·5	4·2	4·5	4·5	5	4·8	4·6	4	4·8
14	20·8	21·7	21·4	21·9	20·8	24·4	23·4	23·4	23·3	23·4	24·7	22·1	23·3	23·4	24·5	24·8	24·4	23	25·6
15	10·1	10·8	10·3	10·2	9·7	12·1	12·1	12·2	12·1	12·5	12·7	10·7	11·2	11·6	12·3	12·3	11·9	11·4	13·3
16	7·4	7·9	7·4	7·4	7·3	8·3	8·1	8·1	8·2	8·5	8·5	7	7·6	7·7	8·2	8·4	7·8	7·6	8·2
17	2·5	2·3	2·6	2·4	2·5	3	2·8	2·8	2·8	2·8	3	2·6	2·7	2·8	2·9	2·9	2·8	2·8	3·2
18	7	7·2	7·1	7·5	6·8	8·4	7·9	7·8	7·4	7·6	8·4	7·7	7·5	8·1	8·1	8·1	8·2	7·5	8·7
19	3·9	3·8	3·8	4·4	3·8	4·6	4·2	4·1	4·1	3·9	4	4·4	4·6	4·4	4·7	4·8	4·6	4·3	4·7
20	6·5	6	6·1	6·5	6·1	6·9	6·8	6·7	6·9	6·8	6·4	6·6	6·7	6·5	6·7	6·7	6·5	6·8	6·5

TABLE I (*k*).—Measurements of Skulls of Indian Members of *Rattus rattus* group (in Millimetres)—*concld.*

Dimension No.	*Rattus nitidus obsoletus.*					*Rattus vicerex.*							*Rattus turkestanicus.*
	Chin Hills.				Simla, 85·8·313 Type.	Sikkim, B. M. 15·9·1.					Kumaon, B. M. 14·7·10.		
	359 ♂	310 ♀	309 ♀	428 ♀	..	·165	·168	·167	S. 3681	3752	·140	·137	11·1·20·1
Teeth : State of Wear :—	mod.	mod.	mod.	much	mod.	mod.	mod.	mod.	½	½			mod.
1	40·2	40·2	41·1	43·1	39	36·6	38·1	39·7	39·1	41	39·1	42·2	37·5
2	42·9	42·5	43·9	45·6	41·2	39·4	40·7	42·2	41·8	44	41·4	44·9	40·2
3	19·9	19·7	20·1	21·3	19·9	20	20·6	20·8	20·5	20·7	20·1	21·2	20·1
4	5·9	6·2	6·1	6	5·9	6·4	6·1	6·3	5·8	5·8	5·5	6·5	5·4
5	16·2	16·1	16·1	17·1	16·1	16·9	16·1	16·6	16·6	16·9	16·9	17·2	16·1
6	14·2	14·4	14·4	15·4	13·9	14·3	14·7	14·4	14·4	14·2	14·5	13·9	14·1
7	13	12·9	13·5	13·8	11·4	11·6	11·5	11·7	11·8	..	12·2	12·4	11·6
8	16·7	16·5	16·6	17·4	15·5	15·9	15·8	16·4	16·2	16·7	16·4	17·5	15·8
9	9·9	9·6	9·7	10	9·8	9·5	9·5	9·8	9·6	9·5	9·7	10·1	9·7
10	19·2	19	19·5	19·5	18·4	16·5	17·2	17·8	18·1	18·7	18·5	20·3	17·3
11	10·6	10·1	9·8	10·4	10·7	9·8	9·8	10·5	10·3	11·1	10·8	11·6	10·3
12	17	16·4	17·4	18·6	15·4	14·1	15·5	15·6	16·2	17	16·1	16·6	14·2
13	4·6	4·6	4·5	5	4·4	4·7	5	5·1	5·1	4·8	4·4	4·8	4·1
14	23·1	22·7	23·7	25·2	21·5	20·7	21·6	22·7	21·7	22·9	21·2	23·5	20·5
15	11·2	11·1	11·5	12·8	10·6	9·5	10·4	11·2	10·4	11·7	10·4	11·6	10·4
16	7·7	8·2	8·3	8·4	8·1	7·2	7·1	8·1	8·1	8·3	8·4	8·1	7·3
17	2·7	2·9	2·6	2·5	2·5	2·1	2·4	..	2·5	2·6	2·7	3	2·4
18	7·6	7·5	7·6	8	8	6·7	7·3	7·8	8	7·9	7·5	8·3	7·1
19	3·9	4	4	4	4·1	4·4	4·5	4·4	4·1	4·3	4·1	4·2	4·5
20	6·3	6·5	6·5	6·6	6·9	7·5	7·2	7·4	6·7	6·9	7	6·7	7·3

TABLE II (*a*).

Dimension.	*Rattus rattus Non-Asiatic.*			*Rattus rattus tistæ.*			
	R. rattus alexandrinus, & frugivorus.	*R. alexandrinus*, Spain.	*R. frugivorus*, Cyprus.	Pashok.		Sikkim (other localities).	Jalpaiguri.
				White bellied.	Slaty bellied.		
	No. of Skulls :— 23	8	4	5	5	4	1
1	37·5—45	38·4—42·1	40·2—43	36·8—38·9	36—39·8	37·5—40·2	40·8
	40·5	**40**	**41·8**	**37·8**	**37·7**	**38·4**	
	100	**100**	**100**	**100**	**100**	**100**	**100**
2	104—108	104—107	106—107	105—107	106—109	103—105	105·5
	106	**105·6**	**106·7**	**106·1**	**107·4**	**104**	
3	48·6—53·9	48·6—53·9	49·8—53·1	51·3—54·2	52·7—54·2	51·9—54·1	
	50·9	**51.1**	**51·8**	**52.6**	**53·3**	**53**	**49·8**
4	13·8—15·9	14·1—15·9	14·4—15·4	14·4—15·4	14·8—15·6	14·5—15·7	
	15	**15·2**	**14·9**	**14·9**	**15·2**	**15**	**14·7**
5	35·4—43·8	38·5—42·4	40·3—41·1	40·1—43·1	40·6—44·2	40·4—43·1	
	40·1	**40.7**	**40·7**	**41·8**	**42·4**	**41·7**	**40**
6	31·1—38·2	33—38·2	35·2—36·4	35·5—38·5	34·2—38·7	34·3—39·2	
	34·8	**35·6**	**35·8**	**36·3**	**36·9**	**36·8**	**35·5**
7	....	29·7—33·3	30·2—33·3	30·6—34·8	30·8—34·7	29·9—34·6	
		31·1	**32**	**32·6**	**32·6**	**32·6**	**30·9**
8	37·8—42·6	37·8—41·6	38·1—40·7	39·6—42·4	40·4—41·7	40 —41·6	
	40·3	**40·1**	**39·8**	**40·8**	**41·1**	**40·5**	....
9	22·8—26·2	23·3—25·4	23·7—24·4	23·4—25	23·8—25·4	23·1—25·7	
	24	**24·1**	**24·1**	**24·2**	**24·8**	**24·2**	24
10	45·8—48·9	45·8—48·6	46·4—48·3	44·2—45	43·9—44·8	43·9—47·8	
	47·4	**47·2**	**47·3**	**44·7**	**44·4**	**45·5**	45·3
11	25·1—28·4	26·7—28·4	25·1—27·7	24·9—27·4	26 —27·6	26 —27·3	
	27·1	**27·4**	**26·6**	**26·6**	**26·8**	**26·7**	**27·7**
12	33·6—40·7	36·7—39·8	37·4—39·2	38·1—39·9	36·6—38·5	37·1—38·7	
	38·1	**38·4**	**38·1**	**39·2**	**38·4**	**37·9**	**39·2**
13	9·4—12·4	9·75—11·5	9·9—10·5	10·25—11·35	9·5—11·1	9·9—10·7	
	10.55	**10·4**	**10·3**	**10·7**	**10·3**	**10·4**	**10·3**
14	55·3—57·5	55·5—57	55·3—56·6	57·5—59	57—58·7	56·7—59	
	56·1	**56·1**	**56·1**	**58·2**	**57·8**	**58·1**	**57·6**
15	25·3—28·3	27·1—28·3	26·1—27·8	27·5—28·6	26·1—28·4	26·2—28·7	
	27·2	**27·7**	**26·9**	**28·1**	**27·5**	**27·6**	**27·4**
16	17·1—20	17·1—18·8	18·4—19·9	18—19·3	17·7—20·1	17·9—19·6	
	18·6	**17·9**	**18·9**	**18·7**	**19**	**18·9**	**19·6**
17	5·2—7·7	5·6—7·3	6—7·7	5·15—6·45	5·8—6·5	5·3—6·4	
	6·3	**6·3**	**6·6**	**6**	**6**	**5·8**	**5·9**
18	17·5—20·3	18—19·9	17·5—19·5	18·8—19·6	17·7—19·8	18·7—19·3	
	18·6	**18·9**	**18·3**	**19·1**	**18·9**	**18·9**	**18·1**
19	9·7—11·3	10·3—10·9	10·2—10·7	10·8—12·1	11·1—13·3	10·7—11·7	
	10·45	**10·6**	**10·5**	**11·3**	**11·8**	**11·2**	**11·3**
20	13·6—17·3	14·3—16·7	15·8—16·7	16·2—18·7	17·6—20·3	16·5—17·9	
	15·8	**15·4**	**16·1**	**17·8**	**18·9**	**17·2**	**17·2**
5	**100**	**100**	**100**	**100**	**100**	**100**	**100**
7	....	72—81·1	79—82	74.4—80·7	71·3—80·8	74—83·4	
		77·5	**80·5**	**77·5**	**77**	**78·3**	**77·3**

TABLE II (*b*).

Dimension.	*Rattus rattus bhotia.*	*Rattus rattus arboreus.*	*Rattus rattus narbadæ.*	*Rattus rattus girensis.*	*Rattus rattus sataræ.*
	Hasimara Bhutan.	Bihar and Orissa.			
	No. of Skulls :— 8	8	7	4	4
1	35·1—38·9 **37·4** **100**	38·3—40·3 **39·5** **100**	36·9—40·5 **38·4** **100**	34·4—39·2 **37·1** **100**	39·3—40·1 **39·7** **100**
2	105—108·5 **106·7**	104—106 **105**	105—106·5 **105·7**	105.5—108·5 **106·5**	106·5—108 **107·6**
3	50·4—53·6 **52**	49·6—53·9 **52·1**	48·7—51·2 **50·1**	50·3—50·8 **50·6**	49·1—50·4 **49·8**
4	13·8—16·1 **14·8**	14·1—16·2 **15**	14.3—16 **15·4**	14·8—16·6 **15·7**	14·5—14·8 **14·7**
5	41·4—43·6 **42·2**	40·1—42·3 **41·3**	39—43.4 **41·1**	40·9—42·5 **41·7**	42—42·9 **42·4**
6	35·2—38·3 **37**	32·5—36·8 **35·5**	33·4—39 **36·7**	34·6—37·8 **36.2**	39—39·8 **39·3**
7	30·9—35·6 **33**	29·2—31·3 **30·7 (1)**	28·6—36·9 **32·5**	29·5—32·2 **31·1**	31·3—33·9 **32·6**
8	40·9—41·9 **41·3**	38·1—41·5 **40·3**	39·2—42·1 **40·5**	39·6—41·2 **40**	39·2—41 **40·2**
9	23·4—25·7 **24·6**	23·2—25·1 **24·1**	22·7—25·1 **24·2**	23·5—24·7 **24·1**	22·5—24·6 **23·8**
10	43·7—45·5 **44·8**	46—47·2 **46·6**	45·1—48·1 **46·5**	45·5—46·9 **46·2**	44—45 **44·5**
11	26·1—27 **26·5**	26·2—27·8 **27·2**	26·4—28·1 **27·4**	26·7—27·7 **27·2**	25·2—26·7 **25·9**
12	37·5—40·5 **38·6**	36·5—39·2 **38**	37·3—39 **38·1**	37·6—39·4 **38·4**	37·5—39·4 **38·6**
13	9·7—11 **10·4**	10·7—11·3 **10·9**	9·65—11·5 **10·7**	9·9—10·7 **10·4**	9·6—10·2 **9·95**
14	57·4—58·8 **58·1**	57—58·8 **57·6**	55·1—57·5 **56·4**	55·9—57·8 **56·7**	58·3—59·2 **58·6**
15	25·8—29·1 **26·9**	27—29·5 **28·3**	27—29 **27·7**	26·6—28·4 **27·5**	27·6—29·4 **28·5**
16	18.3—21.5 **19·4**	18·9—20·5 **19·8**	18·2—20·1 **19·3**	19·1—21 **20·5**	19·5—21·8 **20·3**
17	5·4—6·55 **5·8**	5·1—7·2 **6·4**	6·5—6·95 **6·8**	6·4—7·25 **6·9**	6·85—8·15 **7·45**
18	17·7—19·3 **18·7**	17·6—19·1 **18·2**	17·7—20 **18·6**	17·7—18·6 **18·2**	17—17·8 **17·3**
19	10—12.6 **11·45**	10·1—11·7 **10·8**	9·9—10·9 **10·5**	10·2—10·75 **10·45**	9·75—10·6 **10**
20	17·5—19·2 **18·5**	15·1—17·3 **16·3**	15·5—17·5 **16·4**	15·8—18 **16·6**	16·6—17·8 **17·4**
5	**100**	**100**	**100**	**100**	**100**
7	73·8—85·1 **78·2**	73—76·8 **74·4 (2)**	73·4—85·1 **78·9**	69·7—78·1 **74·7**	73·3—79·9 **76·8**

(1) 6 range between 31 & 31.3. (2) 6 range between 73 & 74·1.

TABLE II (*c*).

Dimension.	*Rattus rattus wroughtoni.*								
	Dharwar.		N. Mysore andKanara.	S. & E. Mysore.	Coorg.		Coonor.	Travancore.	
	No. of Skulls :— 2		4	3	2		3	6	1
1	37·7 **100**	37 **100**	38·9—40·2 **39·4** **100**	38·6—40·9 **39.9** **100**	38·6 **100**	43·2 **100**	36—39·4 38 **100**	36·1—38·6 **37·4** **100**	36·9 **100**
2	107	107	105·5—107 **106·5**	105—106 **105·5**	105	105	106—107·5 **106·6**	107—109 **107·4**	105·5
3	51·8	52·2	49·1—51 **50·2**	48·9—50·1 **49·3**	48·2	49·1	49·7—53 **51·4**	49·8—52·3 **51·3**	50
4	15·1	16·2	14·7—16·4 **15·6**	14·7—15·4 **15.1**	16·6	15·1	15—15·9 **15·5**	14·5—16·5 **15·5**	15·2
5	42·2	44·1	39·9—41·1 **40·3**	38·4—40·5 **39·2**	40·7	40·8	41·1—42 **41·3**	41·1—43·4 **42·5**	42
6	38·2	39·8	34·9—38·6 **36·4**	33·7—36 **34·9**	35·5	35·9	35·9—36·7 **36·3**	36·3—40 **38·3**	37·9
7	33·2	34·3	31·4—33·5 **32·4**	30—31·6 **30·8**	31·6	30·1	32—35·3 **33·1**	32·1—36 **34·3**	34·1
8	42·2	42·7	39·4—40·9 **40·1**	38·9—40·3 **39·7**	39·9	39·8	40·6—41·1 **40·8**	37·4—41·5 **40·2**	39·5
9	24·2	25·4	22·5—23·9 **23·2**	23·8—24·3 **24·1**	23·3	23·4	24·1—25·5 **24·9**	23·7—25·8 **25**	24·7
10	47·8	46	46·5—47 **46·7**	47·4—48·1 **47·6**	46·1	44·9	47·2—47·8 **47·4**	46·3—47·2 **46·9**	46·9
11	28·7	25·7	26·9—27·1 **27**	27·3—27·6 **27·4**	26·2	25·5	26·6—28·4 **27·6**	26·3—27·9 **27·1**	28·2
12	38·2	38·7	37·9—38·5 **38·1**	37·2—38·9 **37.8**	39·4	39·1	37·7—39·8 **38·5**	36·9—39·9 **38·7**	38·2
13	10·35	11·3	10—10·5 **10·3**	9·3—11·2 **10·3**	10·6	10·4	10·4—11·4 **10·9**	9·85—11·7 **10·8**	10·6
14	55·5	57·7	56—57·3 **56·5**	56·5—56·8 **56·6**	57·8	58·6	57—57·7 **57·3**	55·7—57·7 **56·7**	56
15	26·3	28·4	27·5—28·4 **27·7**	26·6—28·1 **27·3**	28·2	28·9	27·5—27·8 **27·6**	25·7—29·1 **27·4**	28·2
16	19·4	20·6	18·6—20·3 **19·3**	19·3—20·8 **19·9**	19·2	19·9	18·4—19·5 **19**	18·1—20·6 **19·3**	20·3
17	6·9	6·75	6·2—7·45 **6.8**	6·35—7·9 **7·2**	7·25	7·2	7—7·5 **7·2**	6·35—6·8 **6·6**	7·3
18	18·8	19·7	17·6—19·5 **18·7**	17·8—19·4 **18·4**	19·2	17·6	18·9—20 **19·5**	18—19·2 **18·5**	18·7
19	10·1	10·3	9·5—10·7 **10**	9·2—10·4 **9·7**	10·1	10·4	9·15—10·4 **9·9**	9·4—10·8 **10·1**	9·75
20	16·5	17	15·9—17 **16·6**	15·1—15·9 **15·4**	16·3	17·1	15·5—16·1 **15·9**	15·3—17 **16·3**	16·3
5	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
7	78·6	78	78·8—82·3 80·3	77·7—80·3 78·7	77·8	79	76·2—84·2 **79·5**	77·5—83·5 80·8	81·3

TABLE II (*d*).

Dimension.	*Rattus rattus kandianus.*	*Rattus rattus gangutrianus.*	*Rattus rattus sikkimensis.*				
			Pashok.	Hasimara, Bhutan.	Jalpaiguri, Bengal. (?)	Sikkim, various localities.	Gopaldhara.
No. of Skulls :—	8	8	8	1	1	4	3
1	34·1—42·7 38·3	38·4—43·4 40·8	39·4—44·2 41·4	41·5	39·8	37·5—42·5 39·7	38·3—41·7 40·3
	100	100	100	100	100	100	100
2	107—110 108·8	105·5—107 106·5	102—106 104·3	105	102	105—105·5 105.2	104·5—106·5 105·5
3	47·4—52 49·8	48·7—52·1 50	50·4—52 51·3	53	53	50·1—51·7 50·8	51·8—52·8 52·4
4	14·9—17·1 15·7	14·6—15·4 15	14—16·3 14·9	14·7	15·1	14·4—15·2 14·6	15·2—16·4 15·8
5	40·9—44·4 42	39—42·7 40·5	38·7—41·6 40·1	39·8	39·7	38·9—41·5 40·5	40·8—43·8 42·2
6	36·1—40·3 37·6	33—37·3 35·6	31·5—35·7 33·7	33·5	33·4	33·9—35·2 34.7	33·4—37·3 35.5
7	31·6—37 33·1 (1)	29—33 31·5	24·7—28·4 26·7	25·6	27·4	27·1—27·9 27·6	25·9—30·6 28·6
8	38·1—42·1 40·2	38·8—42·2 40·1	37·8—40·4 39·1	38·8	39	37·9—40·5 39·2	40·3—40·8 40·6
9	23—25·2 24·2	22·7—25·1 23·8	22·5—24·3 23·2	23·4	23·3	22·6—24·3 23·8	23·3—25 24·3
10	44·7—47 46·3	44·6—46·5 45·5	44·4—46·6 45·3	44·9	44	43·7—45·6 44·5	44·9—45·7 45·2
11	25·1—27·4 26·2	26·3—27·5 27	25·4—28·2 26·2	25·6	26·1	24·6—26.6 25·7	25·5—26·6 26·2
12	38·1—44 39·9	37·5—42·9 39·5	37·6—40 38·9	40·5	36·2	38·3—39·5 39·1	37—40·1 38·6
13	10·8—12·3 11·56	10·3—11·7 10·9	10·4—11·3 10·9	10·85	10·3	10·4—11·2 10·9	10·8—11·5 11·1
14	55·5—58·7 57	56·4—58·7 57·3	56·6—59·4 57·8	58·9	57·8	58·2—59·3 58·7	58·2—58·3 58·3
15	26·1—28·8 27·7	27—28·9 27·7	26·8—29 27·7	28·2	28·4	27·2—28·1 27·6	26·9—28·2 27·7
16	19—21·9 20·1	18·9—21·4 20·1	19—19·9 19·5	20·5	19·8	18·9—19·8 19·4	19·4—20·3 19·8
17	6·5—8 7·2	6·2—7·1 6·5	6·1—7·5 6·6	6·75	6·5	6·35—6·7 6·6	6·25—6·85 6·5
18	18·4—19·5 18.9	16·8—19 18	17·2—19·5 18·4	18·3	19·6	17·7—18·8 18·1	17·8—19.6 18·6
19	9·85—12 10·5	10·15—11·6 10·8	10.4—11·9 10.9	10·9	11·3	10·4—11·5 10·9	10·75—11 10·9
20	15.4—17 16·4	16·3—18·5 17·1	16·2—18·3 17·3	17·6	17·8	17·2—19·5 18·1	17·3—18 17·7
5	100	100	100	100	100	100	100
7	75·6—83·3 78·6	74·6—84·2 77·9	63·9—70·6 66·6	64·2	69	67—67 67	63·6—72·7 67·8

TABLE II (*e*).

Dimension.	*Rattus rattus khyensis.*	*Rattus rattus tikos.*	*Rattus rattus tatkonensis.*	*Rattus rattus rufescens.*				
				Kumaon.	Central Provinces.	Nimar.		Khandesh.
	No. of Skulls :— 14	7	9	6	8	2		1
1	34·7—42·8 **38·1** **100**	39·4—41·9 **40·3** **100**	37—41·8 **39·5** **100**	36·8—40·2 **38·8** **100**	36·3—40·5 **38·4** **100**	37·3 **100**	37·8 **100**	43·3 **100**
2	104—109 **106·5**	103·5—107·5 **105·5**	104—107·5 **106·5**	104—107 **106**	104·5—108 **106**	105	107	105
3	47—53·5 **50·4**	46·3—50·8 **48·7**	48·5—54·8 **51**	51·6—53·1 **51·2**	48·9—52·5 **50·3**	50·1	50·2	..
4	14—17 **15·3**	13·4—16·7 **15·6**	14·1—16·1 **14·9**	14·9—17·2 **15·85**	14·4—16·8 **15·5**	15·8	14	14·5
5	39·2—45·9 **41·5**	38·6—42 **40·1**	37·1—42·5 **40·6**	40—43·2 **42**	39.8—43·2 **41·4**	44·8	41	38·6
6	32·7—41·8 **37·1**	34·2—38·4 **36·1**	34·2—39 **36·5**	34·6—39·1 **37·1**	34·8—38·9 **36·5**	38·6	38·1	32·6
7	26·8*—36·6 **31·7**	28·4—32 **31·1**	28·9—34·3 **31·6**	29·5—34 **31·7**	30·4—35 **32**	34·8	33·3	30·7
8	39—43·5 **40·8**	38·4—42·2 **39·8**	39·4—42·8 **41·2**	39·7—42·9 **41**	38·7—42 **40·6**	41·8	40·7	40·6
9	23·3—26·8 **24·6**	22·5—25·4 **24**	23·5—25·4 **24.2**	23·9—25·8 **24·7**	23·2—24·8 **24·1**	25·2	25·1	23·5
10	42·9—47·4 **45·6**	45·2—47 **45·9**	44·5—47·9 **46**	45—47·5 **46·3**	45·2—47 **46·2**	45·8	46·5	46·6
11	26—28·5 **27·2**	26·1—29·1 **27·4**	26·2—28·9 **27·4**	25·8—28 **26·8**	26·4—28 **27**	27·9	27·2	26·1
12	35·7—40·6 **38**	37·3—40 **38·4**	36·7—40·2 **38·2**	35·6—39·8 **38**	36·5—39·4 **38·5**	36·4	38·9	38·8
13	9·35—12·25 **10·8**	10·7—12 **11·3**	10—11·8 **10·7**	9·75—11·3 **10·45**	9·8—11·5 **10·5**	10·2	10·3	10·6
14	57—58·4 **57·8**	56·1—58·8 **57·7**	56—59·2 **57·6**	56·4—58·4 **57·2**	56—57·7 **56·7**	55·8	56·3	..
15	25·7—29·2 **27.2**	26·9—28·8 **27.7**	26—28·6 **27·2**	27·4—28·6 **28·1**	27—28·4 **27·7**	28·4	27·8	28·8
16	17·6—21·2 **19·3**	18·3—20·8 **19·7**	17·5—21 **18·9**	19·2—21 **19·9**	19—21·2 **20·1**	20·1	19·8	20·5
17	5·4—7·5 **6·25**	5·65—7·3 **6·4**	5·75—7·1 **6·35**	6·25—8 **6·9**	5·95—7·4 **6·55**	7	6·1	6·9
18	17·4—19·4 **18·5**	17·5—19·6 **18·3**	17·3—19·2 **18·2**	17·2—20·7 **18·8**	17—18·8 **18·1**	19·3	18	18·7
19	10·3—11·9 **11·1**	10·3—11·9 **11·1**	10·3—11·6 **11**	9·95—12·1 **10·7**	10—12·2 **10·65**	10·45	10·6	10·4
20	16·5—20·7 **17·9**	16·2—17·7 **17**	15·9—19·7 **17·6**	15·7—17·4 **16·5**	15·8—17·5 **16·7**	16·1	16·9	14·5
5	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
7	67·8†—80·3 **76·5**	72·7—82·3 **77·6**	73—82·4 **78**	70·7—80·1 **75·4**	72·4—83 **77·3**	78	81·3	79·7

* In 15·5·5·228 Kin ; next lowest 29·2.

† In 15·5·5·228 Kin ; next lowest 74·2.

TABLE II (*f*).

Rattus rattus rufescens.

Dimension.	Gwalior.	Kathiawar.	Cutch.	Palanpur.	Koyna.	Dharwar.	
	No. of Skulls:— 4	5	6	3	3	2	
1	35·6—39·1 **38·1** **100**	36·4—38·1 **37** **100**	37·2—38·7 **37·7** **100**	37·4—41·1 **39·6** **100**	36·9—40 **38·6** **100**	36·1 **100**	39·6 **100**
2	105—106 **105·6**	106—109 **107**	104—108·5 **107**	104—107 **105·3**	106—107 **106·3**	106·5	105·5
3	52—53 **52·5**	50—52 **50·8**	49·6—51·2 **50·4**	49·1—52·2 **50·6**	48·2—51·1 **49·5**	51	48·5
4	14—16·6 **15·5**	14·6—16·2 **15·3**	15·8—16·8 **16·1**	14·6—16·3 **15·3**	14·4—15·2 **14·8**	16·6	15·7
5	40·3—44·1 **42·1**	41·2—43·4 **42**	42·4—43·7 **43**	39·2—43·6 **41**	39·8—43·6 **41·6**	42·1	40·9
6	34·3—40·8 **37·5**	35·2—39·3 **37·3**	35·9—39·2 **37·5**	34·6—38·2 **36·1**	35·8—39·6 **37·1**	36·9	36·9
7	30·4—34·8 **32·5**	31·5—34·3 **33**	31·8—34·7 **33**	32·2—33·7 **33**	31—34·1 **33**	34·1	33·1
8	41—42·7 **42**	40·5—42·5 **41·6**	41—43 **41·8**	39·1—41·4 **40**	40·8—43·1 **41·6**	42·1	40·4
9	24·6—25·1 **24·8**	23·6—25·1 **24·3**	24·3—25·2 **24·8**	24·1—24·8 **24·3**	23—25·7 **24·4**	25·5	24·8
10	45·5—48·9 **47·4**	46·2—49 **47·3**	46·2—47·5 **46·8**	45·7—47·7 **46·5**	47·3—47·7 **47.5**	46·5	46·8
11	26·4—28·4 **27·2**	27·2—28·9 **27·8**	27·4—29 **28·2**	26·7—27·5 **27·1**	27·5—28·5 **28·2**	28·2	27·3
12	37·7—39·2 **38·5**	37·8—39·6 **38·8**	37·2—39·9 **38·7**	37·7—39 **38·4**	36·8—39 **37·7**	39·1	36·9
13	10·1—11 **10·6**	9·75—10·8 **10·25**	9·75—11·1 **10.7**	9·9—10·4 **10·1**	9·5—11 **10·1**	10·5	10·6
14	55·4—57·8 **56·3**	55·1—57·2 **56**	55·5—56·6 **56**	57—57 **57**	55·4—55·5 **55·5**	57	56·9
15	26·7—29·2 **28**	26·7—28·4 **27·4**	26·1—27·6 **26·9**	28·2—28·3 **28·2**	27·1—28·3 **27·5**	27·7	27·5
16	19·7—21 **20·2**	19·2—21 **20**	19·5—20·7 **20**	19·3—19·8 **19·6**	18·5—19·2 **19**	20·8	19·5
17	6·9—7·9 **7·4**	6·5—7·15 **6·9**	5·95—7·1 **6·4**	6·4—7·4 **6·8**	6·2—7 **6·5**	7·5	6·8
18	18·2—19·4 **18·8**	17·3—19·2 **18·1**	18·1—19·3 **18.5**	18·4—19 **18·7**	15·9—17·8 **17·1**	18·6	18·2
19	10·1—10·5 **10·2**	9·7—10·5 **10·1**	10·2—11·6 **10·8**	10·4—10·7 **10·5**	8—10·3 **9·1**	10·25	9·85
20	15·6—17·4 **16·1**	15·2—17·9 **16·5**	16·1—17·7 **16·8**	15·3—17·1 **16·4**	15·5—16·8 **16·2**	15·8	15·4
5	**100**	**100**	**100**	**100**	**100**	100	**100**
7	75·4—79 **77·1**	76—81·4 **78·4**	73·7—79·8 **76·6**	77·3—84·5 **80·5**	75·2—85·5 **79·6**	81	81

TABLE II (*g*).

Dimension.	*Rattus rattus rufescens.*					*Rattus rattus nemoralis.*	*Rattus rattus alexandrinus.*		
							Sind.		
	N. Mysore and Kanara.			S. E. Mysore.	Coonor.		Dark Belly.	White Belly.	
	No. of Skulls :— 2			5	1	6	6	2	
1	39.7	41.1	34	36.9—39 **37.8**	36.2	36.4—41.7 **38.4**	37—40 **38.6**	35.5	37.9
	100	**100**	**100**	**100**	100	**100**	**100**	10	**100**
2	107	108	108.5	106—107 **106.3**	108	106—109 **108**	104—106 **105.1**	106.5	107
3	50.2	50.7	..	48.2—52.3 **50.5**	48.3	51.3—52.2 **51.9**	52.2—54.6 **53.4**	49.6	51.4
4	14.9	15.3	16.2	14.7—16.3 **15.7**	15.5	15.4—16.8 **16.1**	14.8—15.8 **15.3**	14.7	15.8
5	40.3	39.5	43.2	40.1—42.9 **42**	41.5	38.3—43.3 **41**	40—41.9 **41**	40.6	42.5
6	35.5	36.5	38.8	36.3—38.7 **37.4**	38.4	35.4—39.1 **37.1**	35—37.9 **36.8**	36.9	39.8
7	31	31.4	33.8	30.7—36 **33**	32.6	30.4—37.4 **33.3**	30—34.4 **32.6**	31.3	..
8	40.6	40.9	40.9	38.5—42.1 **40.5**	38.7	37.6—42.1 **40.9**	39.3—41.8 **40.6**	39.8	40.9
9	23.2	24.6	24.1	23.3—25.2 **24.5**	23.5	22.8—25.6 **24.4**	23—24.7 **23.8**	24.5	24
10	45.9	46.5	46.5	46·9—48.2 **47.5**	46.7	46—48.2 **47.1**	46.6—48.5 **47.8**	47.1	47.5
11	27.2	26.6	28.2	26.7—27.6 **27.2**	27.6	25.7—28 **26.6**	25.8—27.5 **26.6**	27.1	27.4
12	39.6	39.2	36.7	36.8—39.6 **38.3**	37.8	36—39.7 **38.5**	36.1—37.6 **36.8**	38	37.7
13	11.1	11.5	10.3	9.5—11.5 **10.1**	10.5	10.9—12.2 **11.4**	10—12 **11**	10.7	9.5
14	57.3	57.4	56.2	54.7—56.6 **55.9**	56	57—58 **57.4**	56.1—57.7 **56:8**	56.6	55.7
15	28.7	27.1	25.9	26—28.4 **27.3**	27.9	27.1—29.1 **28**	25.7—27.9 **27**	25.7	27.4
16	18.7	18.5	19.7	18.5—19.6 **19.2**	21	17.6—20.3 **19.2**	18—20.3 **19.4**	19.4	18.5
17	7.05	6.8	6.5	6.2—7.2 **6.6**	6.6	6—8.5 **7.3**	5.4—7.35 **6.6**	5·9	6.1
18	19.7	18.5	18.5	17.7—18.7 **18.2**	18.8	17.6—19.3 **18.6**	18—20.1 **19**	18	18.5
19	10.1	10	10.6	9.75—10.5 **10.1**	9.4	9.8—10.7 **10.2**	9.5—11.1 **10.3**	10.4	11.1
20	16.7	15.3	18.2	15.3—16.8 **16.1**	17.1	14.6—16.5 **15.5**	14.2—19 **16.7**	18	18.5
5	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
7	76.9	79.6	78.2	76—85.3 **78.5**	78.7	78.6—86.7 **82.2**	75—83.4 **79.5**	77.1	..

TABLE II (*h*).

Dimension.	*R. macmillani.*	*R. kelaarti.*	*Rattus nitidus nitidus.*		
			Kumaon.	Sikkim.	
	No. of Skulls :— 4	5	5	7	
1	35·5—38·4 **37·2** **100**	36—37·9 **36·8** **100**	40·5—42·6 **41·1** **100**	38·9—43 **41** **100**	44·4 .. **100**
2	106—108 **107·2**	109—110 **109·3**	105—106·5 **105·5**	105—108 **106·1**	102·5
3	48·8—51·9 **50·2**	49·9—52·8 **51·1**	48·4—51·2 49·8	48·8—52·9 50·5	50·3
4	14·4—16·6 **15·7**	16·1—17·4 **16·5**	14·5—15·6 **14·9**	14·6—15·6 **15·1**	14·6
5	42·6—44· **43·3**	42—43·9 **43·1**	38·6—40·3 **39·4**	38·9—41·7 **40·6**	37·1
6	36·8—39·5 **38·1**	36·4—38·9 **38**	34—36·5 **35·3**	35·1—38·4 **37·3**	33·8
7	29—33·8 **31·5**	31·9—34·9 **33·4** (2)	29·8—32·8 **31·4**	31·2—34·2 **33**	29·7
8	39·7—41·1 **40·1**	39·6—41·1 **40·6**	38·5—40·1 **39·6**	39·5—41·2 **40·5**	38·5
9	23—25·9 **24·7**	24—25·8 **24·6**	23·2—25·3 **24·5**	23·7—25·7 **24·7**	21·4
10	44·7—45·5 **45·2**	44·5—47·2 **45·9**	44·7—46·4 **45·5**	44·5—47 **46·1**	46
11	26·1—26·9 **26·4**	25·9—27·5 **26·3**	23·6—25·6 **24·7**	25—25·8 **25.4**	25
12	38—39·6 **38·8**	38·6—41·6— **39·8**	42·5—44·7 **43·9**	41·5—43·7 **42·8**	40·1
13	10·7—11·8 **11·2**	11·2—12·4 **11·9**	10·4—11·7 **10·9**	10·8—11·8 **11**	10·8
14	57·8—58·9 **58·3**	57·1—59·2 **57·9**	56·8—58 **57·5**	56·8—58·8 **57.6**	57·7
15	25·6—28 **27·2**	26·9—29·4 **27·7**	29·4—30·8 **30**	27·5—29·2 **28·3**	30
16	19·1—20·2 **19·8**	19·5—21·5 **20·3**	19·7—20·9 **20·1**	18—19·5 **18·9**	**18·5**
17	5·7—7·6 **6·9**	6.3—7 **6·7**	6·8—7·05 **6·9**	6·6—7·15 **6·8**	7·2
18	17·5—18·3 **17·9**	18·9—19·8 **19·3**	18·2—19·7 **19**	18·5—19·8 **19·2**	19·6
19	10·7—11·5 **11·3**	10·2—11·6 **10·7**	9·4—10·2 **9·9**	10·7—11·35 **11·1**	10·6
20	17·5—19·7 **18·4**	16·4—17·9 **16·9**	15—17 **16·3**	15·3—17·4 **16·2**	14·6
5	**100**	**100**	**100**	**100**	**100**
7	68·1—77·2 **72·9**	76·1—80·5 78	76·5—82 80	78·7—84 **81·3**	80

TABLE II (*i*)—*concld.*

Dimension.	*Rattus nitidus obsoletus.*	*Rattus vicerex*				*Rattus turkestanicus.*
	Chin Hills.	Type.	Sikkim.	Kumaon		
	No. of Skulls :— 4	..	5	2		
1	40·2—43·1 **41·1** **100**	39 .. **100**	36·6—41 **38·9** **100**	39·1 **100**	42·2 **100**	37·5 **100**
2	106—107 **106·5**	**106**	106·5—107·5 **107**	**106**	**106**	**107**
3	48·9—49·6 **49·2**	51·1	50·4—54·7 **52·8**	51·4	50·2	53·6
4	13·9—15·4 **14·7**		14·9—17·5 **15·6**	14·1	15·4	14·4
5	39·2—40· **39·8**	41·3	41·2—46·2 **42·8**	43·2	40·7	43
6	35—35·8 **35·4**	35·7	34·6—39·1 **37·1**	37·1	33	37·6
7	32—32·8 **32·3**	29·2	29·5—31·7 **30·4**	31·2	29·4	31
8	40·4—41·6 **40·9**	39·8	40·7—43·4 **41·7**	42	41·5	42·1
9	23·2—24·7 **23·8**	25·1	23·2—26 **24·7**	24·8	24	25·9
10	45·3—47·8 **46·9**	47·2	44·9—46·3 **45·4**	47·3	48·1	46·1
11	23·8—26·4 **24·9**	27·5	25·7—27·1 **26·5**	27·6	27·5	27·5
12	40·8—43·2 **42·1**	39·5	38·6—41·5 **40·3**	41·2	39·3	37·9
13	10·9—11·6 **11·4**	11·3	11·7—13·1 **12·3**	11·2	11·4	10·9
14	56·5—58·5 **57·5**	55·1	55·5—57·2 **56·4**	54·2	55·7	54·7
15	27·7—29·7 **28·3**	27·2	26—28·5 **27·3**	26·6	27·5	27·8
16	19·2—20·4 **19·8**	20·8	18·6—20·7 **19·9**	21·5	19·2	19·5
17	5·8—7·2 **6·5**	6·4	5·75—6·4 **6·2**	6·9	7·1	6·4
18	18·5—18·9 **18·7**	20·5	18·3—20·5 **19·4**	19·2	19·7	18·9
19	9·3—10 **9·7**	10·5	10·5—12 **11·2**	10·5	10	12
20	15·3—16·2 **15·7**	17·7	16·8—20·5 **18·4**	17·9	15·9	19·5
5	**100**	**100**	**100**	**100**	**100**	**100**
7	80·1—83·9 81·2	70·9	68·7—71·5 **70·4**	72·2	72·2	72

INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S.

(*With Text-figures.*)

(*Continued from page 744 of Volume XXVI.*)

Part VI.

GENUS—TRITHEMIS, Brauer.

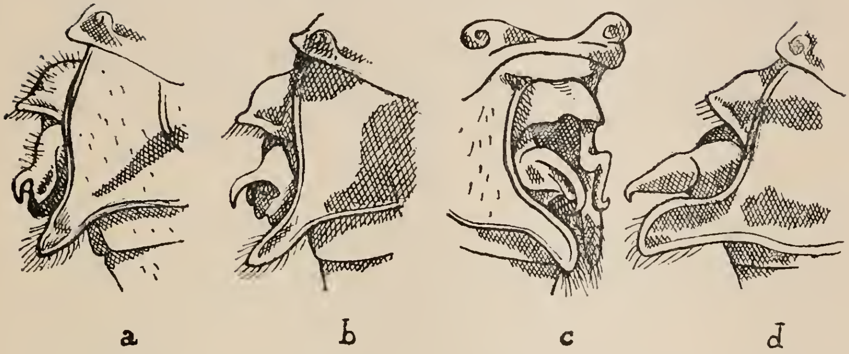

Fig. 48.—Male sexual organs of ; a. *Trithemis festiva*, b. *Trithemis pallidinervis*, c. *Trithemis aurora*, d. *Trithemis kirbyi.*

Head proportionate in size ; eyes shortly contiguous ; forehead variable, with or without a marked foreborder, usually without in the female ; suture challow ; vesicle moderately high.

Prothorax with a small posterior lobe, rather hidden beneath the head.

Thorax moderately narrow. Legs long and slim: the hind femora with a row of closely-set, smallish spines, gradually lengthening distally ; mid femora with less numerous spines and some longer ones at the distal extremity. Femora in the female resembling the mid femora of male. Tibial spines numerous, fine and of medium length. Claw-hooks robust, springing from the middle of claws.

Abdomen of variable shape according to the species and also to the age of individual specimens. Most often clavate and somewhat depressed or else markedly fusiform. The base somewhat dilated dorso-ventrally and usually some constriction at the 3rd segment. In the female, the shape is more generally cylindrical. In *festiva* and *pallidinervis* the sides are more or less parallel

Wings relatively broad and long, especially in *pallidinervis*. Hyaline or parti-coloured ; reticulation close. Trigone in the forewing a little distal to the trigone in the hind ; sectors of the arc with a long fusion ; arc between the 1st and 2nd antenodal nervures ; antenodal nervures $8\frac{1}{2}$ to $15\frac{1}{2}$, the final incomplete , 8th nervure arising from the anal angle of the origone in the hindwing, occasionally slightly separated ; relation of trigone in the forewing to hypertrigone rather more than a right angle, this trigone narrow and traversed, in the hindwing free (very occasionally traversed in *kirbyi*). All hypertrigones entire; subtrigone with 3 cells; 1 cubital nervure to all wings (*kirbyi* often has 2 in the hindwing); 4th nervure variable, straight or undulated; 2 rows of cells between 5 and *5a.*; discoidal field with 3 rows of cells or rarely 1 or 2 rows of 4; more or less contracted at the termen; anal field of hindwing broad and loop well developed; 4 or more rows of cells between the loop and the basal margin of wing; divided cells at the anal and external angles of the loop. Membrane large. Stigma usually small and in one species bicolourous.

Sexual organs: those of the male on the 2nd segment, large, the tentaculæ variable and described under species; lobe usually long, fairly straight and narrow. Female: border of 8th segment not dilated; no distinct vulvar scale; 9th ventral plate keeled, furnished with 2 small spines, the free border tongue-shaped and overlapping the 10th ventral plate.

Four species of this genus are found within Indian limits, two of which are found throughout India and are probably about the commonest dragonflies we have in this country; the other two are local and one at least may be considered scarce. A fifth species comes from Mesopotamia.

KEY TO SPECIES.

I. Adult forms.
    A. Abdomen fusiform or clavate and depressed. Thorax and abdomen bright crimson, this colour slightly violaceous due to a thin pruinescence.
        i. Antenodal nervures 11½ to 15½ .. *T. aurora aurora.*
        ii. Antenodal nervures 9½ to 10½ .. *T. annulata.*
    B. Abdomen slim, cylindrical or triquetral.
        i. Thorax and abdomen bright vermilion red, with no frosting .. .. .. *T. kirbyi kirbyi.*
        ii. Thorax and abdomen black, this colour violaceous due to a thin pruinescence. *T. festiva.*
        iii. Thorax golden brown, abdomen black marked with yellow .. .. .. *T. pallidinervis.*

II. Teneral forms.
    C. Abdomen very slightly fusiform or the sides parallel and depressed, ochreous.
        i. Antenodal nervures 11½ to 15½ .. *T. aurora aurora.*
        ii. Antenodal nervures 9½ to 10½ .. *T. annulata.*

57. Trithemis aurora aurora, Ris, 1911.

Trithemis aurora, Brauer, 1868, Selys, 1882, Kirby, 1889, 1890, Karsch, 1891.
Trithemis soror, Brauer.
Trithemis adelpha, Selys.
Trithemis fraterna, Albarda.
Trithemis congener, Kirby.
Trithemis intermedia, Kirby.
Trithemis yerburyi, Selys.
Trithemis liturata, Selys.
Libellula aurora, Burm. 1839, Hagen, 1858, Calvert, 1898.

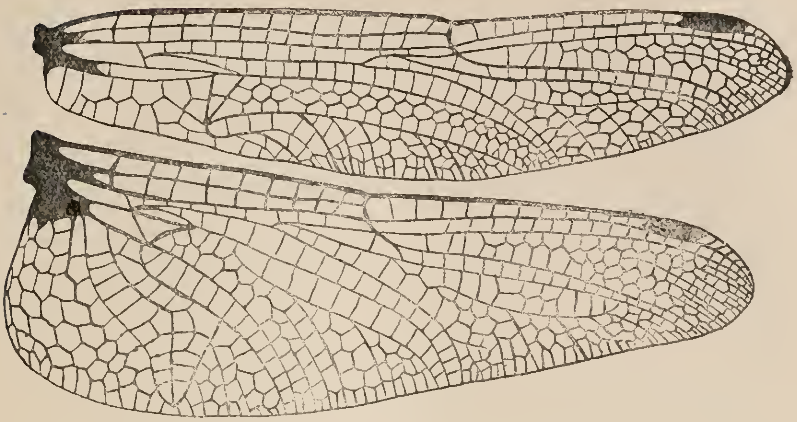

Fig. 49.--Wings of *Trithemis aurora aurora* showing neuration.

Expanse 50 to 55 mm. Length 32 to 35 mm.

Male : Head : eyes bright red or crimson above, brown at the sides and lilaceous beneath : occiput brown ; vesicle and upper part of forehead a glossy, metallic red with an iridescent bluish sheen ; epistome ochreous or reddish, labrum and labium yellow, both bordered variably with black.

Prothorax black with an ashy collar anteriorly.

Thorax purple or crimson with a bluish pruinescence on the dorsum, laterally a golden brown in the adults or bright yellow in teneral forms marked with three parallel, black stripes, the first midway beween the humeral region and the spiracle, the second over the spiracle and the third over the metepimeron. Often these three are joined at about their middle by an irregular horizontal stripe. The dorsum is edged with a black, humeral stripe.

Legs ferruginous above, black beneath.

Wings hyaline, the reticulation crimson as far as stigma. The basal spot golden brown with red reticulation and darker brown rays in the inferior costal and cubital spaces. The latter rays are also present in the forewings. The basal spot of hindwing variable in extent, usually extending as far as trigone and may or may not reach the tornus. Antenodal nervures variable ; in five consecutive specimens examined, they numbered 13½, 14½, 15½, 11½ and 10½. Stigma small, bright crimson bordered heavily with black.

Abdomen crimson with a bluish pruinescence. A black, lateral spot on the 10th segment. Base slightly dilated, then constricted and then markedly fusiform, and depressed. In some specimens there is an additional black mark on the sides of the 9th segment, but this and the mark on the 10th are very variable in extent. Anal appendages red, the superior having the tips black.

Sexual organs : male : lamina broad and depressed, notched shallowly in the middle ; internal tentaculæ attenuated and curving outwards ; external not marked ; the lobe narrow and relatively long.

Male teneral form.

Juvenile forms of this and *annulata* show surprising differences when compared with the adults. The differences are not limited to colour alone but also to shape, so much so, that for a long time I was in doubt as to whether the teneral forms were not entirely different species Further study and observations and by collecting a complete series ranging from very teneral to adult forms has shown that they are one and the same insect.

The teneral form differs in the following particulars from the adult insect:—

The eyes are brown above instead of blood red ; the face is bright yellow with no trace of red or ochreous.

Prothorax ochreous. Thorax pale greenish yellow or grey or almost white, with the same markings as in the adult but offering a greater contrast by reason of the pale ground colour and the total absence of pruinescence. The lateral black stripes are often incomplete but the black outline of an "envelope" on the under surface of the abdomen, which is a specific character of all trithemiNæ, is well defined.

Legs black, the tibiæ striped outwardly with bright yellow.

Wings with bright yellow reticulation instead of crimson ; the basal marking of a paler tint and not as extensive as in adult *aurora*. Stigma black.

Abdomen much narrower and more sharply carinated on the dorsum. There is usually some suggestion of the adult fusiform shape but in the earliest stage, the abdomen has nearly parallel sides. Pale ochreous in colour or with a reddish tinge according to age. The spots on the 9th and 10th segments are usually present but not as well marked as in the adult. Anal appendages yellow.

Female : head : eyes purple brown or fawn above, lilaceous or slaty tint beneath. (The dark colouring in all species of *Trithemis* is present as a sharply limited cap on the summit of the eyes), occiput black, spotted with yellow behind or in young forms the occiput may be a golden brown ; vesicle and clypeus ochreous or these and the labrum bright yellow, the latter edged with black. Often there is a black streak on the upper surface of the forehead. Labium olivaceous edged with black.

Prothorax black with anterior and posterior, yellow collars more or less in evidence.

Thorax pale whitish green with the following markings :—an obscure, pale brown stripe on the mid-dorsal carina, the latter itself finely yellow and dividing this fascia into two ; a similarly coloured humeral fascia better defined and three fine, black, lateral, oblique lines as in the male.

Wings hyaline, the apices diffusely marked with brown for a variable extent up to as far as the middle of the stigma. Stigma reddish brown with black borders. Reticulation a bright yellow usually but may be brown or nearly black. The basal spot about as extensive as the male but a paler colour and the dark rays absent.

Abdomen with parallel sides, nearly cylindrical, ochreous with black markings which are variable in extent and may almost obscure the ground colouring, the dorsal carina finely to broadly black, the borders similar. The 1st, 2nd and 3rd segments are largely yellow, but this colour decreases in extent as traced towards the anal end, until on the 9th and 10th it is represented only by a subdorsal spot on each side of the middorsal carina. On the first 3 segments there is a subdorsal black streak dividing the yellow ground colour into inner and outer yellow spots. Beneath black, with a lateral yellow spot on each segment except the last two.

Teneral forms do not differ markedly from the adults, they are paler in tint and the wings lack the brown apices. The abdomen is ochreous with a blackish brown, interrupted, subdorsal line on the first 3 segments which gradually approaches and fuses with the black line bordering the remaining segments. A fine middorsal black line on the carina. Anal appendages black. In the adult female these are ochreous with black tips.

Hab. Throughout Continental India in the plains, but ascending to 3,500 feet, in the Southern Hills at least. I have specimens from Shillong, Karachi, Bombay, Madras and Ceylon and from parts of the Deccan, but with the exception of the extent of the basal marking in the hindwing, they show but little variation. It is one of the commonest Indian dragonflies and is found throughout the year in Southern India in the plains. In the Deccan, it is not common until the month of April, when it suddenly appears in large numbers along the banks of rivers, streams or tanks. It breeds in running water for preference, keeping to the shallows, where large numbers of the larvæ may be found by lifting up curtains of spirogyra.

58. Trithemis annulata, Ris, 1908. Coll. Selys.
Libellula annulata, Paliset de Beauvais.
Libellula rubrinervis, Selys, 1849, Hagen, 1856, Selys, 1860.
Trithemis rubrinervis, Brauer, 1868, Selys, 1887, Kirby Cat., 1890, Calvert, 1893, Martin, 1894, 1895, Maclachlan, 1897, Kirby, 1897.
Libellula obsoleta, Rambur, 1842.
Trithemis obsoleta, Brauer, 1868.
Libellula hæmatina, Rambur, 1842.
Expanse 64 mm. Length 37 mm.

The colouring of this species both for male and female is exactly similar to *aurora*, but it is readily distinguished from the latter by the following specific characters:—the size is much greater, some of the females being of comparatively great size; the antenodal nervures number only 9½ to 10½ and lastly, the rays in the inferior costal and cubital spaces seen in *aurora* are absent. The basal marking in the hindwing varies as in *aurora*, but is similar in colour.

Teneral forms of *annulata* are exactly similar to those of *aurora* except for the three differences noted above for the adults.

Annulata replaces *aurora* or rather the latter replaces the former in India, *annulata* being found in Mesopotamia. The differences between the adult and teneral forms in the one and the other are a most striking analogy and furnish the most convincing proof of the relation between these forms.

Hab. Mesopotamia, Africa generally and Madagascar, throughout Asia Minor and the Mediterranean coast. Specimens from Suez are exactly the same as those from Mesopotamia. I include this species on account of its striking analogy to *aurora* and also to the close association which Mesopotamia has now with this country.

59. Trithemis kirbyi kirbyi, Ris, 1911.
Trithemis aurora, Kirby, Proc. Zool. Soc., 1886, Cat. 1890.
Trithemis kirbyi, Selys, 1891.
Male: Expanse 56 mm. Length 35 mm.

Head: eyes reddish brown or bright red above, pale brown laterally and beneath. In some specimens there is an equatorial ring of red just below the red cap and this is followed by a delicate lilac tint: occiput brown: vesicle, forehead and upper part of epistome bright vermilion red fading to yellow below: labrum and labium yellow.

Prothorax ochreous with a black collar in front and another behind.

Thorax olivaceous to golden brown, suffused with a peach-blossom tint at the humeral and metepimeronal regions, the intervening area being a pale greenish white. In many specimens the sides are suffused with bright crimson. All that is left of the humeral stripe is a tiny black spot, often entirely absent and on the sides are two more or less obsolete stripes, one crossing the spiracle, incomplete above, the other on the posterior suture, incomplete below. Beneath the usual black outline of an envelope.

Wings hyaline with a very variable, basal spot; the reticulation bright crimson, this colour extending as far as the apex along the costa and 2nd nervure (radius); stigma deep blood red with black margins and paler extremities; antenodal nervures 10½ to 11½; the trigone in the hindwing often traversed (in one of my specimens, this is traversed twice), in some specimens, the trigone of one wing only is traversed; quite occasionally the costal border of the trigone is strongly convex so that the distal angle meets the 7th nervure by means of an abrupt backward angulation of the latter, this bent part forming a fourth side to the hypertrigone; in some specimens two cubital nervures are present; the basal marking a dark amber tint, extending in most specimens as far out in the forewing as the 4th or 5th antenodal nervure, the outer ends of hypertrigone and trigone and a variable area in the anal region. In the hindwing as far out as the 5th antenodal nervure, 2 cells beyond the outer end of the trigone and from thence in a slight analwards curve as far as the termen, the outer part of the loop being excluded. In other specimens the marking is limited to a broad spur in the costal and cubital spaces as far only as the 3rd antenodal and not extending into the trigone; in the hindwing to half-way between the 3rd and 4th antenodals, to the distal end of the trigone and posterior to this as a more or less isolated patch in the anal area, not reaching the termen or anal margin; a third form has only dark rays in the inferior costal space, the cubital plus trigonal space and in the hindwing, a small, diffuse, faint spot in the anal area, in which the cell-middles are paler than their margins. (I possess one specimen in which the basal marking is of average extent but is of a smoky brown and in which all the cell middles are clear, the appearance being that of a coarse, brown network.)

Abdomen brilliant vermilion red with small black middorsal spots on he 9th and 10th segments and occasionally similar coloured, wedge-shaped spots on the distal borders of the 8 and 9th segments. Anal appendages bright red.

Legs reddish, the inner surfaces of the hind femora black.

Sexual organs: lobe arched and sloping; internal tentaculæ stout, almost straight hooks; the lobe long, narrow, straight and projecting.

Female: Head: eyes reddish brown on summit, lilaceous at the sides and beneath, the beginning of an equatorial ring in front just below and parallel to the cap; vesicle pale ochreous above, yellow in front; occiput roddish-brown; face pale yellow, a deeper colour below; labrum and labium pale whitish green.

Prothorax olivaceous with a black collar in front and behind.

Thorax much paler than that of the male but the markings better defined. The sides generally suffused with a beautiful peach-blossom tint.

Abdomen brick red on the dorsum, pale olivaceous at the sides where there is often a suffusion of peach-blossom tint. Long, fine, subdorsal streaks of black which are almost obsolete on the first few segment, but strongly marked on the 5th to 9th, absent on the 10th; middorsal, black spots on the 8th and 9th as in the male but somewhat larger. Anal appendages ochreous.

Legs olivaceous, the coxæ tinted with peach-blossom.

Wings hyaline; the basal marking variable, in some specimens only a suspicion of yellow rays in the costal and cubital spaces of forewing and in the hind reaching as far as the 1st antenodal nervures, halfway across the subcostal space, nearly to the outer end of the cubital space and then curving strongly to the tornus; in others the marking is almost as extensive as in the male, but the cell middles are usually clear and give a characteristic stippled appearance to the wing base.

Hab. The insect is found locally in many parts of India from far North to far South. I have not seen it among material sent from the North-West nor from Burma. It is reported from Ceylon. My own specimens have almost all been taken in the Deccan where I have found it to be very local and I have also taken it in Madras, but not in Bombay. It is a shy and very active insect and not easily captured. Rough nullahs and the rocky shores of streams and rivers are its favourite haunts and in such places it is invariably seen settled on rocks or such like bare spots, where its brilliant orange red colouring makes it a conspicuous object. The females are rare and are only found, when coming to water for purposes of ovipositing. I have had to haunt the places where the males congregated for days together before I succeeded in capturing a specimen.

60. Trithemis festiva, Brauer, 1868, Selys, 1879, Kirby, 1886.

Libellula carnatica, Fabr., 1798.
Libellula festiva, Rambur, 1842.
Libellula infernalis, Brauer, 1865.
Dythemis infernalis, Brauer, 1866.
Trithemis infernalis, Brauer, 1868, Selys, 1878.
Trithemis prosperina, Selys, 1878, Kirby, 1890.
Libellula cyprica, Martin ?
Trithemis cyprica, Martin, 1894.
Male : Expanse 60 mm. Length 35 mm.

Head : eyes deep purple above or dark brown with a purple sheen, slate blue at the sides and beneath ; vesicle and upper part of forehead glossy metallic violet ; epistome and labrum dark olivaceous brown with a darker brown middle or the labrum black with a brown base ; labium blackish brown , occiput dark brown.

Prothorax deep indigo blue.

Thorax black, but appearing purple owing to a thin pruinescence.

Abdomen black, the first three segments only with bluish pruinescence.

Legs black.

Wings hyaline but sometimes in old specimens faintly tinted; stigma black; a basal marking in the hindwing which varies in size and density, usually there is a dark, smoky brown ray in the inferior costal space and another in the cubital space, the former not reaching the first antenodal nervure, the latter extending beyond the cubital nervure. From the cubital space the marking is continued in an even curve to nearly as far as or to the tornus. Little variation in the neuration of this insect is seen.

Sexual organs : male : lamina low and broad, its surface coated with bright brown hairs ; external tentaculæ quadrangular, the internal short and strongly hooked backward ; the lobe small, pointed and narrow, arched more than in the other species.

Teneral forms of the male are much livelier coloured and approach that of the female. With the exception of the upper part of forehead and labrum, the face is a bright greenish yellow ; the labium similarly coloured.

Thorax bright greenish yellow with black markings as follows :—a moderately broad middorsal fascia split by the mid-dorsal carina which is yellow, a broad humeral stripe and laterally three oblique stripes connected above with each other; the tergum and interalar sinus yellow.

Abdomen black marked with yellow as follows :—all the dorsum of the 1st three segments, the colour here being traversed by fine black lines at the sutures and transverse ridges; a window-shaped mark consisting of four panes on the 4th segment; oval dorsal spots on the 5th to 7th, decreasing in size progressively as traced backwards; the sides of the first three segments, the yellow here being separated from that on the dorsum by a black line; beneath a broad midventral spot on all segments from 1 to 7.

The basal marking of wing is usually not as extensive as in the adult forms and is of a deep golden brown.

Female very similar to teneral males, but the whole insect more robust and the abdomen thicker and nearly cylindrical. In the male this is slim and strongly keeled and the last few segments are a little dorso-ventrally dilated. The yellow is more extensive and the black markings conversely less in evidence.

Head: eyes puce brown above, pale lilaceous grey at the sides and beneath; vesicle and upper part of forehead not metallic, the former brown, the latter and the face pale dirty yellow.

Thorax pale brown on the dorsum, the mid-dorsal and humeral regions a little darker and usually the latter bearing traces of a fine black line. Laterally the sides are pale yellow with similar but finer black lines as seen in the male.

Abdomen a pale reddish or olivaceous brown, somewhat variable with black margins which gradually encroach on the pale dorsal area and meet over the dorsal carina on the last three segments. The sides of the fist three segments yellow. Legs yellowish brown.

Basal spot of hindwing bright golden brown. Some specimens have the apices of all wings tipped with brown as far as the distal end of stigma.

Hab. Throughout India, Ceylon, Burma and Indo-China, New Guinea, Borneo, Java, Formosa, Mesopotamia, Asia Minor. The insect is extremely common and is found throughout the year except in the Northern areas in the cold season.

It is not often seen away from water and prefers running to still waters. Females are comparatively rare.

61. **Trithemis pallidinervis,** Morton, 1907.

Sympetrum pallidinervis, Kirby, 1889, Id. Cat., 1890.
Trithemis dryas, Selys, 1891.
Diplax dryas, Martin, 1904.

Expanse 71 mm. Length 43 mm.

Male and female very similar in appearance, the later however is paler and the yellow markings greater in extent on the abdomen.

Head: eyes reddish brown above, brown at the sides and slate blue beneath; vesicle, upper and front part of frons iridiscent, metallic purple in the male and light yellow in the female, in which there is only a broad basal line to the forehead, metallic blue green; epistome and labrum light brown in the male, very pale yellow in the female; labrum yellow with black borders; occiput olivaceous or yellow.

Prothorax dull brown.

Thorax dull brown with a diffuse blackish brown mid-dorsal stripe and on the sides which are pale yellow, a post-humeral and two lateral black stripes. the front one crossing the spiracles and the hind over the posterior suture.

The humeral stripe curves abruptly back below but does not quite touch the stripe crossing the spiracle; which latter is incomplete above. In addition there is a fine humeral stripe incomplete above and below. Beneath, the usual black, envelope marking.

Wings long and broad, the reticulation very fine and giving a peculiarly characteristic invisible appearance to the wings. Stigma of forewing in the male distinctly larger than that of the hind, dark reddish brown, whitish at the extremities (stigma of female distinctly larger than that of male); a golden brown, basal marking in both wings extending about halfway to the 1st antenodal nervure, not as far as the cubital nervure in the forewing but well beyond it in the hind; 8½ antenodal nervures; always 2 rows of cells between 5 and 5*a* (quite occasionally there is only 1 row in other species of the genus); membrane blackish.

Abdomen long and slender in the male, much stouter in the female, the sides almost parallel and in the male, the internodal joints distinctly swollen. Black marked with yellow. each segment (except the 8th, 9th and 10th in the male) bearing a long, oval, subdorsal spot. In the female there is a small point of yellow on the 8th and two small spots of the same colour on the distal half of the 10th. The sides of the first three segments broadly yellow; the ventral surface pruinose. Anal appendages pale yellow with black tips in both sexes.

Sexual organs: male: lamina broad and somewhat depressed; external tentaculæ short, internal short, backwardly directed, robust hooks; lobe very slightly arched, small and very narrow, yellow. Female as in all species of the genus, the borders of the 8th segment not dilated; vulvar scale small and inconspicuous.

Pallidinervis has a distinct facies of its own which at once separates it from all other members of the genus. With the exception of the small lobe to the prothorax and the contracted discoidal field, there are few features which place it as a *trithemis*. The differences between it and other species may be briefly summarised and are so many that *pallidinervis* might well be given generic rank.

a. The insect is much larger than all other species of *trithemis*. A moderate sized *pallidinervis* may be as much as 20 mm. greater in expanse than a small *aurora*, or 15 mm. greater than *kirbyi*, or 11 mm. than *festiva*.

b. The differences between the sexes is almost negligible when compared with those of the other species, in fact it is much less than the differences between teneral males and adult females.

c. The legs are characteristically long and spidery, the hind reaching far beyond the hind border of the hindwings.

d. The hind femora have a row of closely-set spines that are of even length and there is a single longer spine at the distal end of the femora.

e. The mid femora have a row of widely-set, gradually lengthening spines.

f. The armature of the hind femora in the female is exactly the same as in those of the male.

g. The wings are relatively very long and characteristically clear and diaphanous.

h. The stigmata in the wings of the male differ in size.

Pallidinervis and *kirbyi* represent the two ends of the scale in the chain of evolution, the former being the most highly developed, the latter very occasionally presenting archaic characters.

Hab. Locally throughout India. Poona, Bombay, Deesa, Thibet, Ceylon, Madras.

The insect is generally found perched high up on the summit of tall reeds, beds of bull-rushes being a favourite site. It is peculiar in this habit and therefore generally a solitary insect. The long, spidery legs are bunched together and fully extended, so that its body appears stalked to the resting place, whilst the wings are held slightly elevated and the abdomen pointed almost perpendicularly in the air. Although common where found, I have so far failed to locate its larva which is apparently a ank breeder.

Genus—RHYOTHEMIS.

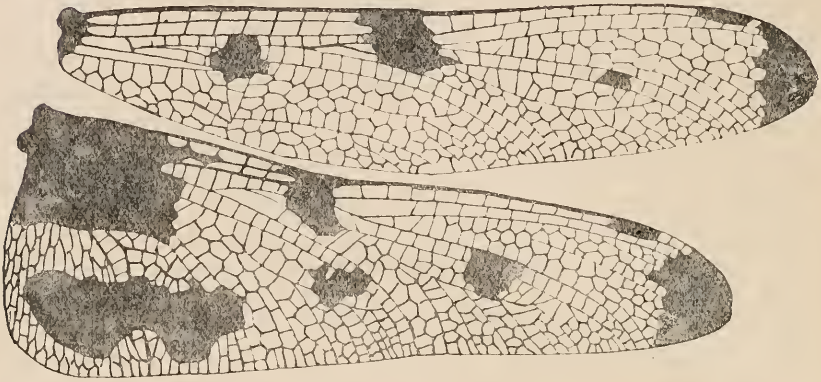

Fig. 50.—Wings of ♂ *Rhyothemis variegata* (× 2·8).

Rhyothemis, Hagen, 1867.
Libellula, Rambur, 1842.

Head relatively small ; eyes broadly contiguous, the junction about equal to the depth of the occipital triangle ; forehead prominent and rounded, similar in both sexes ; suture deep ; vesicle large and prominent; occiput small.

Prothorax with a small posterior lobe which is narrowly arched and ciliated along its free border.

Thorax narrow and relatively small.

Legs long and slim, similar in the two sexes. Hind femora with a row of widely-set, smallish spines and one longer one at the distal end ; mid femora with longer and less numerous spines. Tibial spines numerous, very fine. Claw-hooks robust, situated near the end.

Abdomen short and compressed laterally. Somewhat fusiform in the male, a little cylindrical in the female. A transverse ridge on the 4th segment.

Wings long and broad or short and broad, varying usually in the shape in the sexes ; reticulation close ; generally more or less coloured with black or black and yellow, the former colour with a more or less metallic reflection ; trigone in the forewing 3 to 4 cells beyond the line of the trigone in the hind ; sectors of arc separated in the forewing, but usually joined for a short distance in the hind ; arc between the 1st and 2nd antenodal nervures, often opposite the 1st ; 8th nervure at the anal angle of trigone ; 7½ to 10½ antenodal nervures, the final incomplete ; base of trigone in the hindwing at the arc ; 1 cubital nervure to all wings ; no accessory nervures to the bridge; relation of trigone in hindwing to hypertrigone about a a right angle; trigone in the hindwing entire; hypertrigone in the forewing generally traversed, that of the hind usually entire; 4th nervure with only a slight undulation, its end bent abruptly towards the termen; 1 to 2 rows of cells between 5 and *5a*; the discoidal field more or less contracted at the termen and filled with 3 to 5 rows of cells; anal field of the hindwing very broad; the midrib of the loop nearly straight, its angulation commencing very near the trigone so that the end segment, or toe of the loop is relatively long, its outer angle broad and filled with numerous cells, the space between the midrib and inner border very narrow; the space lying between the loop and anal border of wing filled with numerous rows of narrow cells arranged transversely. Membrane moderately large. Stigma short.

Sexual organs: male: lamina broad and depressed at the base, the border rounded and projecting; tentaculæ small, the internal backwardly curving, robust hooks, the external small and angular; lobe small and narrow.

Female: borders of the 8th segment not dilated; 8th ventral plate prolonged into a small, projecting vulvar scale; 9th ventral plate broad, carinated at the end, not overlapping the 10th ventral plate, 10th very small.

Key to Species.

Wings marked with black and yellow.

At least 2 rows of cells between 5 and *5a*.

i. Sexual differentiation very marked.

Male with the whole of wings, suffused with yellow. Forewing with spots at the node, trigone and at the middles of 5 and *5a*, and 7 and *7a*. Hindwing similar but with two additional, transverse, basal bands. Female with broader and shorter wings than the male, all apices of wings hyaline, much more so in the fore than hind wing, the black markings more extensive than in the male and the spots coalesced to form broad fasciæ which traverse the wing from costa to termen .. .. *R. variegata.*

ii. Sexual differences both in shape and colour, less marked.

Male with apices of all wings tipped with brown. In the forewing usually only a well marked, black spot at the node, but often a poorly marked, diffuse spot over the middle of 5 and *5a* and possibly a similar spot at the trigone. In the hindwing similar spots, a ray in the intercostal space at the base, and two transverse, basal fasciæ which are not as extensive as in *variegata.*

Female similar to male, but the marks usually more extensive or better marked. Apices of all wings tipped with brownish black .. *R. phyllis phyllis.*

II. Wings marked with black only.

At least 2 rows of cells between 5 and *5a*. Wings entirely black with a metallic lustre, except the extreme apices which are hyaline. .. *R. plutonia*

III. Only 1 row of cells between 5 and *5a*.
Base of both wings black with a bluish, metallic reflection, in the forewing as far as the trigone, in the hind nearly as far as the node .. *R. triangularis.*

62. Rhyothemis variegata variegata, Hagen.

Libellula variegata, Linne.
Libellula marcia, Drury.
Rhyothemis marcia, Hagen.
Libellula murcia, Fabr.
Rhyothemis murcia, Brauer.
Libellula indica, Fabr.
Libellula histrio, Fabr.
Libellula celestina, Oliv.

Male. Expanse 75 mm. Length 37 mm.

Eyes reddish brown above, olivaceous at the sides and beneath; occiput black; vesicle and forehead metallic green; face and labrum golden yellow labium blackish brown.

Prothorax black.

Thorax metallic green or a coppery green on the dorsum. Very pilose.

Abdomen parallel-sided, dorso-ventrally dilated for the first four segments, metallic, coppery green, pruinose at the sides and beneath. Legs black.

Wings long and rather narrow at the apices, suffused entirely with yellow, marked very variably with black as follows:—the apices of all wings a blackish brown; irregular black spots, very variable in size, sometimes very large, sometimes almost or some at least entirely obsolescent, at the trigone, node and at the middles of 5 and *5a*, and 7 and *7a*. In addition to these, in the hindwing, two irregular, transverse, black fasciæ which lie in a diffuse, framing of deeper yellow than the rest of the wing.

Female: head, prothorax and abdomen coloured the same as in the male. Considerably shorter than the male. Expanse 67 mm. Length 32 mm.

Wings much shorter and broader than in the male and marked very differently. The distal half of the forewing and the apex of the hind from the proximal end of stigma, hyaline and with no tinting of yellow, the remainder of wings suffused with yellow and marked broadly with black, the latter colour preponderating. The tornus narrowly, two rounded indentations at the terminal ends of the 7th and 8th nervures and a variably sized, circular spot in the middle of the outer part of the black fascia, yellow. Also a more or less quadrate spot immediately distal to the node and an irregular, transverse band posterior to the trigone in the hindwing. In the forewing, the termen narrowly and a subcostal ray yellow.

Hab. Throughout Continental India in the moister areas. Ceylon, Indo-Malay, Burma, Thibet, Nepal, Bombay, Madras, Bangalore, Calcutta, Bhamo, Mandalay, Annam.

Contrary to the general rule, females of this and the next and probably of all species of the genus are much in excess of the males. In Bangalore and Madras where I have seen the insect swarming in such numbers that five or six could be taken with a single stroke of the net, not more than 1 per cent. would be males and half of the number taken would be *variegata* and the other half *phyllis*. I captured a hundred specimens one day under the impression that they were all *variegata* but when examining them at leisure I was surprised to find that I had only two males of that species, the remainder being females of that insect and *phyllis*, the latter closely resembling the males of *variegata*. They are to be sought for in marshy areas and will be found to have a habit of dancing in the air in large numbers, looking for all the world like a swarm of gigantic and glorified gnats.

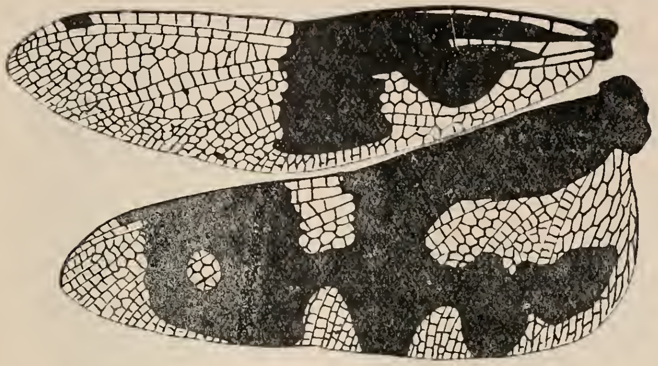

Fig. 51.—Wings of ♀ *Rhyothemis variegata variegata* (× 2·2).

63. Rhyothemis phyllis phyllis, Hagen.

Libellula phyllis, Sulzer.
Celythemis phyllis, Brauer.
Libellula quadripunctata, Roemer.
Libellula vittata, Weber.
Male. Expanse 82 mm. Length 38 mm.
Female. Expanse 70 mm. Length 32 mm.

The sexes very similar in colour although differing in size and somewhat in shape. *Phyllis* is probably the parent form of *variegata* and if a heavily marked male of the former be compared with a lightly marked male of the latter, the differences will be seen to be almost negligible. The female of *variegata* has probably evolved from *phyllis* by a clearing of the apices of the wings and an increase in size of the markings at the base until the spots coalesced.

Head: eyes reddish brown above, olivaceous at the sides and beneath; occiput black; vesicle and forehead metallic green; face and labrum a golden yellow; labium darker yellow or brown.

Prothorax black.

Thorax metallic coppery in the male, metallic green in the female. Legs black.

Abdomen black with a more or less metallic lustre, pruinose beneath in the male only.

Wings entirely suffused with golden yellow, darker at the base and along the costa and in the hind distinctly opalescent. Marked with black as follows :—A nodal spot, larger in the fore than in the hind wing and larger in the female than in the male; the apices of all wings halfway to stigma, paler in the female: a diffuse spot at the outer angle of trigone, larger in the female; two broad, irregular transverse bands at the base, extending variably outward to the 2nd or 4th antenodal nervure and to the distal end of the trigone or 1½ cells beyond the posterior band, to well beyond the outer angle of loop. In the female and also not unoccasionally in the male, additional spots at the middles of the 5th and 7th nervures. Many females have also an additional spot at the terminal part of the discoidal field in the hindwing.

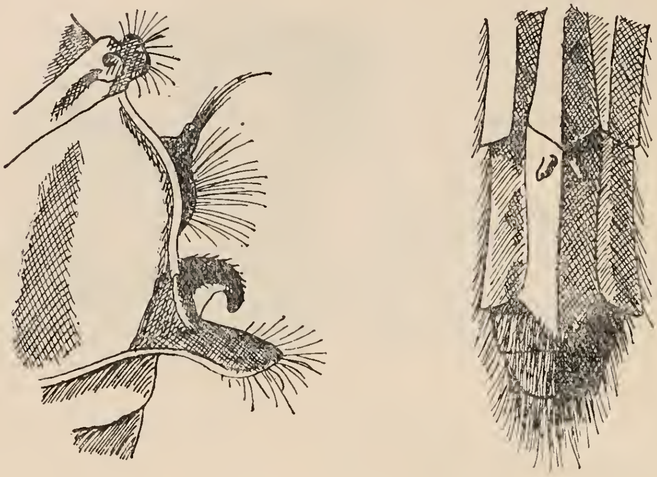

Fig. 52.—Sexual organs of *Rhyothemis phyllis phyllis.*

Sexual organs : As for the genus ; there is absolutely no differentiation between the sexual organs of *phyllis* and *variegata,* both have a very depressed lamina, the apex of which is furnished with a fringe of very stout hairs, a golden yellow in colour, and both have very massive internal tentacula. The females of both species possess horny processes on the 9th ventral plate, near its base.

Hab. Throughout Continental India, Ceylon, Burma and Indo-Malay. This insect is nearly always found in company with the former and what has been said for *variegata,* applies equally well for *phyllis.* The larvæ are found breeding in company with those of *variegata* in the shallow, stagnant waters of marshes. They are short, squat and stoutly built insects, with rather long legs and are remarkably deeply pigmented, being almost black in the living state.

(*To be continued.*)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XXI.

BY OLDFIELD THOMAS, F.R.S., &c.

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A.—SOME NEW MAMMALS FROM BALUCHISTAN AND NORTH-WEST INDIA.

Among the fine series of Mammals from Baluchistan contributed by Col. J. E. B. Hotson to the Bombay Natural History Society there occur a number of interesting small mammals which have been put into my hands for examination.

As a result the following new species seem to require description:—

MYOTIS LANCEUS, sp. n.

A buffy greyish species with woolly fur and deeply notched ears.

Size decidedly larger than in *M. emarginatus*, to which its woolly fur and notched ears give it a certain resemblance.

Fur quite woolly, just about as in *emarginatus*; hairs of fore back and withers over 8 mm. in length, those of hind back 5 mm. Interfemoral slightly hairy proximally above, without fringe; otherwise all the membranes are naked; legs and hind feet with fine hairs on them.

General colour greyish buffy, the hairs slaty at base, with a broad buffy whitish subterminal ring and inconspicuous tawny tip. Undersurface dull creamy white, the hairs white nearly to their roots. Ears of medium length, their inner margin strongly and evenly convex, outer margin angularly emarginate. Tragus straight.

Skull larger and heavier than in *emarginatus*, with broader muzzle; not so large as in *formosus*. Relative proportions of premolars about as in *emarginatus*, the small p^3 in the tooth row.

Dimensions:—Forearm, 45 mm.

Head and body (from dry skin), 55 mm.; tail (c.), 37; ear (wet), 15 × 10; tragus on inner edge, 7; third finger, metacarpus, 39·5; first phalanx, 16; lower leg and foot (c. u.), 30.

Skull: greatest length, 16; median length, 14·6; zygomatic breadth, 10·3; interorbital breadth, 4; breadth across upper canines, 4·4; palato-sinual length, 7·8; maxillary tooth series, 6·8; front of p^4 to back of m^2, 4.

Hab:—Dizak district, Persian Baluchistan. Type from Shastun. Alt. 3,820′.

Type;—Adult ♀. B. M. No. 19, 11, 8, 2. Original number 125. Collected 28th July 1916, and presented by Col. J. E. B. Hotson.

This well marked species is perhaps a large desert coloured eastern representative of the S. European *M. emarginatus*, but further material will be needed before its affinities can be certainly determined. Larger than *emarginatus*, it is on the other hand much smaller than the bright coloured Asiatic species *M. formosus* and its allies, to which there is also a certain resemblance.

MERIONES PERSICUS BAPTISTAE, subsp. n.

A fine bushy tailed jird, with larger bullæ than in true *persicus*.

Size as in *persicus*. General colour gerbil buff, the hairs "warm-buff" with their tips blackish, so that the general tone is darker than in Kelat *M. persicus*. A more ochraceous line along the edge of the white on sides. Ears coloured like the head. Tail heavily tufted, the long hairs attaining 22-24mm. in length; base above ochraceous buffy lined with black, under surface mixed whitish and buffy; tuft at end black, mixed with some white lines.

Skull as in true *persicus*, except that the bullæ are larger, more fully inflated, and generally project backwards behind the level of the back of the supraoccipital (there is some optical illusion in this, the bullæ often appearing to project behind the supraoccipital level when really, as judged by a straight-edge, they only just equal it). In *persicus* they fall decidedly short of the same level.

Dimensions of the type:—Head and body, 132 mm.; tail, 156; hindfoot, 36; ear, 23. Skull: greatest length in middle line, 43·3; diagonal length to back of bullæ, 44. 3; Condylo-incisive length, 39; zygomatic breadth, 22·7; nasals, 18·5; interorbital breadth, 7·8, bi-meatal breadth, 23·3; palatal foramina, 9; diagonal horizontal length of bullæ, 16; front of meatal inflation to back of bulla, 12·2; upper molar series, 5·6.

Hab:—Pasht Kuh, S. W. Baluchistan, about 27° 2′ N., 65° 12′ E. Others from Gwambuk Kaul and Kuldan in the same region.

Type:—Old ♂. B. M. No. 19, 11, 7, 69. Original number 455 Collected 24th March 1918 and presented by Col. J. E. B. Hotson. Four specimens.

Taking provisionally as representing *persicus*, Col. Hotson's series from Kelat, in which the bullæ are exactly of the same size as those of B. M. No. 76, 3, 10, 2, one of Blanford's co-types, this fine Gerbil is distinguished by its darker richer colour, the decidedly greater development of the tail tuft, and its larger bullæ.

M. ambrosius, Thos. of Western Persia is nearly allied, but has a brighter buffy colour and much smaller bullæ.

With the entire agreement of Mr. Wroughton I have named this handsome animal after N. A. Baptista, who acted as Col. Hotson's taxidermist, and to whose collecting powers the Survey is already so much indebted.

DIPODILLUS INDUS, sp. n.

General characters as in *D. nanus* but size distinctly smaller and tail less heavily tufted.

Skull smaller throughout than in *nanus*, and the bullæ especially very considerably smaller. Indeed the bullæ of the Baluchistan species prove to be unusually large for this genus, approaching those of *D. arabium*.

Dimensions of the type:—Head and body, 72 mm.; tail, 117; hind foot, 22; ear, 13.

Skull: (the measurements in brackets those of *D. nanus*) median length, 25·5 (27·6); diagonal length to back of bullæ, 25·6 (28); condylo-incisive length, 22·1 (24); zygomatic breadth, 13·6 (14·7); nasals, 9·7 (10); bi-meatal breadth, 13·8 (14·2); palatal foramina, 4·3 (5); bullæ, diagonal horizontal length, 9·4 (10·3); breadth at right angles to last, excluding meatus, 5·7 (6); upper molar series, 3·2 (3·5).

Hab:—Sind, Kathiawar, and Gujerat. Type from Gambat, Khairpur, Sind.

Type:—Adult ♂. B. M. No. 15. 11. 1. 100. Original number 825. Collected 12th April 1915, by S. H. Prater. Presented to the National Museum by the Bombay Natural History Society.

Six Dipodils are included in Col. Hotson's collection from various localities in S. W. Baluchistan. Blanford having described *D. nanus* from Saman, Dasht, just a little further South-westwards, I have been able to treat them as practically topo-typical of that species and then make a comparison with the Gerbils from Kathiawar and Sind referred to in the Survey Reports Nos. 10, 12, and 24 as *D. nanus*.

I find that the latter are unquestionably different and have therefore described them as above

This clearing up of the identity of Blanford's *D. nanus* is a very useful result of Col. Hotson's collection, for the name has been used for specimens from a number of different localities.

D. indus would appear to be the farthest eastward of the species of *Dipodillus*, and the only one which occurs in India proper.

ALLACTAGA HOTSONI, sp. n.

A very long-eared Jerboa of medium size.

Size decidedly greater than in *A. indica*, but not equalling that of the Central Asiatic species. General colour dull greyish buffy, about as in *A. indica*, or a little darker. Ears enormously long, far longer in proportion than in any other species of the genus, and equalling in actual size those of the largest Jerboas. Usual white hip-stripe present, below which the outer sides of the hips are pale fawn tending towards buffy, not ochraceus as in *williamsi*. Whole of back of leg black down to the ankles, a marking towards which there is little or no tendency in other species. Tail dull fawn with a subterminal black ring about two inches in length, not preceded by a white one. Terminal white tuft growing on the last 15 mm. of the tail, its hairs about 18 mm. in length.

Skull rather larger than in *A. indica*, falling far short of that of *A. williamsi*. Braincase with its broadest point further forward than in the other species, about half-way between the anterior corner of the orbit internal to the lachrymal bone and the back of the skull. Palatal foramina widely open, especially posteriorly. Bullæ very large, larger even than in the much larger *A. williamsi*, and approaching those of *A. mongolica* and *rückbeili*.

Dimensions of the type:—Head and body, 122; tail, 220; hind-foot 58; ear, 41; Skull: upper length, 29·5; condylo-incisive length, 29.5; zygomatic breadth, 21.7; nasals, 11 × 4·6; interorbital breadth, 9; greatest breadth of braincase, 15·7; palatilar length, 16·8; palatal foramina, 5·7 × 3·6; bullæ, breadth at right angles to greatest diameter, 6·5; upper molar series, without p^4, 5.

Hab:—Persian Baluchistan. Type from Kant, 20 miles S. W. of Sib. Alt. 3,950′

Type:—Adult ♀ B. M. No. 19, 11, 8, 56. Original number 111. Collected 17th July 1916, and presented by Col. J. E. B. Hotson. One specimen only.

This most distinct species of Jerboa is readily recognisable by its excessively long ears and, in correlation therewith, by its large bullæ, which equal those of much larger species. It is in all respects larger than *A. indica,* of which Col. Hotson has also sent specimens, while it is smaller, though with larger ears, than any of the larger species of the genus.

As being the most striking of the new species he has been instrumental in discovering in Baluchistan, I have named this interesting Jerboa in honour of Col. Hotson, the donor of the fine collection in which it occurs.

OCHOTONA RUFESCENS VULTURNA, subsp. nov.

Size rather less than in typical *rufescens*, greater than in the Central Persian *O. r. vizier*. General colour in full summer pelage much more uniformly buffy reddish than in the other forms, the light neck band less contrasted with the back, owing to the paler colour of the latter. Forehead and crown buffy cinnamon, the subterminal band of the hairs warm buff, their ends strong cinnamon; band across neck dull buffy; back like crown, not, as in the other forms, with a more reddish shoulder band and greyer hind back, but nearly uniform mixed buffy and cinnamon. Undersurface slaty greyish broadly washed with buffy. Ears like the head. Limbs pale buffy throughout.

Skull with larger bullæ than in *vizier*, rather smaller than in *regina*, and larger than in a Kurum Valley specimen of true *rufescens*.

Dimensions of the type:—Head and body, 167; hindfoot. 32; ear, 23. Skull: uppeı length, 42 mm. (Skull of the more fully adult No. 126, the nasal sutures commencing to anchylose:—upper length, 44; condylo-incisive length, 41·5; zygomatic breadth, 22·7; nasals, 14·2; interorbital breadth, 4·3; parietal breadth, 17·2; greatest bimeatal breadth. 21·5; palatal foramina, 12·3; breadth of palatal bridge, 2·2; bullæ horizontal antero-posterior length, 12·2; oblique diameter on side aspect (upper anterior to lower posterior edge), 11.

Hab:—Kelat region, Baluchistan. Type from Harboi, near Kelat.

Type:—Young adult ♂. B. M. No. 19. 11. 8. 57. Original number 103. Collected 11th August 1917, and presented by Col. Hotson. Two specimens.

The Pikas referable to *O. rufescens* are found over a large quadrilateral corresponding approximately with the northern half of Persia and the whole of Afghanistan. At the north-western corner of this quadrilateral, on the Kopet Dagh, Ashabad and Meshed, there occurs *O. r. regina*, then at the north-eastern corner, at Kabul and in the Kurum Valley, typical *O. rufescens*; at the south-western corner, in Central Persia, on the Korud Range, *O. r. vizier*, and now this very buffy form from the south-eastern corner Kelat and probably Quetta, completes the set.

The series available however is far too small to make it possible to work out the interrelationships of the different forms, especially as the changes of pelage render so many of the specimens not properly comparable with the rest. It is for this reason that I am still in doubt whether specimens from Mastung, S. W. of Quetta and Ziarat, N. E. of same place, are or are not certainly referable to *O. r. vulturna*.

B—TWO NEW SPECIES OF CALOMYSCUS.

BY OLDFIELD THOMAS, F.R.S.

Among the fine collection of Mammals from Baluchistan contributed to the Survey by Col. J. E. B. Hotson, there are no less than 14 examples referable to the rare form *Calomyscus*, of which only one single specimen has hitherto been recorded, and which is remarkable for its close relationship to certain American Muridæ, and wide distinction from all Old World forms except *Cricetus* and its allies. That specimen, the type of *Calomyscus bailwardi*, was captured in the mountains of Western Persia, so that the discovery of the same group in Baluchistan indicates that the genus has an unexpectedly wide range.

With two exceptions I can add but little to the original description of the genus, the type of *bailwardi* having been such a good specimen that most characters were observable upon it. More unworn teeth among the present specimens confirm the surprisingly close alliance of *Calomyscus* with the American *Peromyscus*, or at least with such members of that genus as have no intermediate cross ridges on their molars. Indeed I might even have thought it necessary to synonymize *Calomyscus* with *Peromyscus* had we not now found that there is a constant difference between the two in the number of molar roots. In *Peromyscus* there appears to be always the specialised reduction in number resulting in only two roots being visible on the inner aspect of m^1 and one in m^2, while in *Calomyscus* the condition is the more primitive one of three being visible in m^1 and two in m^2.

The mammary formula appears to be 1—2=6, the number almost invariably present in *Peromyscus*.

As was originally said to be probable, the peculiar white tuft half way along the tail of the type of *bailwardi* does not occur in other specimens, and is no doubt abnormal.

The specimens in Col. Hotson's collection are referable to two species, both new.

CALOMYSCUS BALUCHI, sp. n.

Size as in *C. bailwardi*, but with smaller ears. Palatal foramina longer.

Dimensions about as in *bailwardi*. General colour very much as in that animal, the intensity of the buffy somewhat variable. Ears distinctly shorter, usually 18 mm., in two cases 19, while those of the type of *C. bailwardi* are recorded as 21·5.

Skull very like that of *C. bailwardi*, but rather more slenderly built. Palatal foremina uniformly longer.

Dimensions of the type :—Head and body, 75 mm.; tail, 89 (ranging up to 96); hindfoot, 21; ear, 18.

Skull; greatest length, 26; condylo-incisive length, 22·6 zygomatic breadth, 12·9; nasals, 9·5; interorbital breadth, 4·1; palatilar length, 11; palatal foramina, 5·2; upper molar series, 3·5.

Hab :—Kelat District, Baluchistan. Type from Kelat itself, other specimens from Harboi, 9,000′, in the same neighbourhood.

Type :—Adult ♂ B. M. No. 19. 11. 7. 65. Original number 699. Collected 6th July 1918, and presented by Col. J. E. B. Hotson. Eleven specimens.

Of the two Baluchistan species this is undoubtedly the closer to *C. bailwardi*, but may be distinguished by its smaller ears and longer palatine foramina.

CALOMYSCUS HOTSONI, sp. n.

Smaller than *bailwardi* and *baluchi*. Colour darker.

Size less than in the other two species. Fur equally fine and soft. Colour similar in general pattern but decidedly darker, owing to the greater extent of the blackish tips to the hairs, and the rather darker tone of the ochraceous. Undersurface, hands and feet similarly pure white, and tail equally pencilled, tufted, bicolor, blackish above and white below.

Skull much smaller than in the other species; interorbital region narrower; palatal foramina of medium length; bullæ rather smaller.

Dimensions of the type.—Head and body, 72mm; tail, 77; hindfoot, 19; ear, 18.

Skull: greatest length, 24·5; condylo-incisive length, 21·7; zygomatic breadth, 12.6; nasals, 9·3; interorbital breadth, 3·7; palatilar length, 10; palatal foramina, 4·9; upper molar series, 3·3.

Hab:—Panjgur District, Baluchistan. Type from Gwambuk Kaul, about 30 miles S. W. of Panjgur. 2,700′.

Type:—Adult. ♂ B. M. No. 19. 11. 7. 63. Original number 239. Collected 8th February 1918, and presented by Col. J. E. B. Hotson. Three specimens.

Readily distinguishable from both the other species by its smaller size, narrower interorbital region and darker colour.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I.F.S.

(Continued from page 769 of Vol. XXVI.)

PART XXIV.

36. Genus—RAPALA.

Eyes hairy; body robust; palpi shorter than in *Virachola*, second joint more laxly scaled. All the species are red, blue or brown on the upperside; the undersides are pure ferruginous, ochreous, ochreous-brown, buff-grey or greenish-grey, rufous-brown, lavender-grey, vinous-red, chrome-yellow, often varying in tint, with a short band, discocellular and another postmedial completely across both wings and curving round to the anal margin on the hind wing, this band never *very* broad. They also, all, have a lobe and a thread-like tail to vein 2 on the hind wing. There are 20 Indian species some of which extend to the Malay Peninsula, Nias and Sumatra but none beyond. The Andamans and Nicobars, Assam, Burma and Ceylon are here taken as India.

The species of *Rapala* are all robust, fast-flying insects, fond of flowers and occasionally coming to water. The larva are abnormal in shape being provided with a subdorsal and dorsoventral row of fleshy, erect, tubercular teeth of no great length; the pupa is more or less normal. The larvæ of some species seem to be attended by ants, of others they are not. They all, as far as is known, feed upon flowers. Three species are dealt with here: *schistacea*, *varuna* (= *orseis*) and *melampus*, the first two blue-glossed on the upperside, the third red. The transformations of all three have been described.

191. Rapala melampus, Cramer.—Male. *Upperside*: scarlet. Fore wing: with the costal and outer marginal bands black, of moderate width, gradually increasing from the base to the apex, then gradually narrowing on the outer margin to the hinder angle; veins finely black. Hind wing: with the costal space pale dusky; outer, marginal line finely black; anal lobe black; with some ochreous scales above on the inner side and a few scattered, metallic-greenish scales on the outer side; tail black, tipped with white. *Cilia* black with greyish white tips. *Underside*: pale purplish-brown; markings a little darker than the ground colour, with whitish edges. Fore wing: with the hinder, marginal space pale; a double, dark line at the end of the cell; one on each side of the discocellulars; a narrow, nearly straight, discal line of conjoined, lunular marks from near the costa to the submedian vein, the third from the costa displaced a very little outwards: indications of a series of submarginal marks. Hind wing: with a dark double line at the end of the cell; a discal band of conjoined, lunular marks as in the fore wing; the latter straight from the costa to vein 2, then curving inwards in two angles to the abdominal margin one-third above the anal angle; a subterminal series of indistinct, lunular marks; anal lobe black with some pale whitish-grey scales above it and between it and a black spot in the first interspace; terminal line of both wings dark brown, with a white thread on its inner side in the hind wing. Antennæ black, ringed with white, club with a dull red tip, and a white streak beneath; frons grey, with a brown, median stripe; eyes ringed with white; head and body brown above, with red hairs, pale purplish-brown beneath; the abdomen ochreous-grey.—Female. *Upperside* duller in colour than the male, often more or less brick-red. Fore wing with the marginal bands dark brown or blackish-brown. Hind wing still duller in colour, generally suffused with pale brown. *Underside* as in the male. Expanse 32—40mm.

Egg.—A slightly depressed section of a sphere in *shape*. *Surface* shining; covered all over with extremely minute, slightly concave-bottomed, hexagonal cells which are separated from each other by low, even walls of one-third the width of a cell-diameter and perhaps similar height where these cells are largest—which is anywhere immediately round the micropyle-surface and for a short distance from it; there are about 4 cells to 0·05mm. square; the micropyle-surface is quite circular, depressed and 0·01mm. in diameter; at the intersection of the cell-walls are, one at each, 0.016mm. long, blunt-topped (even slightly dilated-topped), transparent, erect spines or excrescences. *Colour* very light green. B: 0·65mm. H: 0.375mm.

Over 100 eggs were taken out of the body of a butterfly. The size of the cells decreases, as usual, towards the apex in top third and is smallest immediately around the micropyle-surface.

Larva. (Pl. II, fig. 24).—Is of the same *type* exactly as those of *Rapala schistacea* and *varuna*. *Head* hidden by segment 2; surface shining; light-yellow in colour; mandibles white, the mouth opening margined with black; shape round. Segment 2 rounded in front, slightly constricted behind with a notch-emargination in centre of the front margin (dorsal) and a very short, thick tooth at each posterior dorsolateral corner; triangular, dorsal depression light-brown in colour; end segment slightly convex, sloping to end, the last produced out behind in two triangular teeth pointing slightly up; segments 11, 12 each with a similar tooth pointing slightly back and up; segments 3-10 have each a subdorsal and dorsoventral tooth which are all thick at the base and cylindrical at top, short, fleshy; the effect of these two rows is that the dorsum is flat between the ridges of subdorsal teeth on each side; the dorsoventral teeth point out and slightly forwards and the space-area of each segment between the subdorsal and dorsolateral rows is more or less flat and hexagonal-looking; segment 3 is cut nearly square in front through the axis of the teeth. *Surface* of body smooth and (naked ?), tops of the teeth have some hairs on them, all white and short except those on anal segment which has 3 or 4 longish hairs; anal and front margin with longish, fine, white hairs. *Spiracles* very small, situated at base of dorsolateral teeth. *Colour* of larva is pure white with a faint greenish tint and a faint marbling on sides. The larva is broader at segments 5, 6 and is broader than high at that point; at both ends the breadth is equal. L: 18mm.; B: 6mm.

Pupa. (Pl. II., fig. 24).—*Head* hidden under segment 2, the frons not much bowed, high; segment 2 trapeze-shaped seen from above, broadest side posteriorly; thorax stout, humped; abdomen broader and higher at segment 7 than is the case at thorax; the pupa is similar to that of *varuna*. *Surface* clothed with fine, erect hairs on segments 1, 2 along the front margin of latter, on eyes of former; otherwise smooth and more or less dull; two lateral rows of indented spots, one on each side above each depressed spiracle. *Spiracles* of segment 2; facing forwards, oval, white; others light, roundish, in depressions. *Colour* of body brownish-pink, blotched minutely with black, having an undefined, dorsal, blackish line and a blotchy blackish appearance laterally; the segmental membrane 9/10 is marked with distinct raised edge on one side. L : 16mm. ; B : 6mm.

Habits.—These are the same as for *varuna* and *schistacea* as regards the eggs, larvæ and pupæ. The larva is not much attended by ants, if at all; it feeds upon the flowers of *Ougeinia dalbergioides*, called the Chittagong wood. It also probably feeds upon other things. The insects have the same habits of flight as noted for *varuna* and *schistacea* but seem to be more characteristic of the plains than of the jungles; at least they are more frequently found in open country. The distribution is throughout India, Ceylon, the Malay Peninsula, Nias, Sumatra. Captures have been recorded from the Coromandel Coast; Mhow; Bombay; Thana District; Poona; Karwar; Dharwar; Kanara District; Nilgiris; Central Provinces; Chin Lushai in Burma; Masuri; Matheran; Sikkim; Nias and Sumatra.

192. Rapaia schistacea, Moore.—Male. *Upperside*: dark slatey-blue. the lower disc of the fore wing and the disc of the hind wing shot with brilliant blue in certain lights. Hind wing: abdominal fold pale brown. Anal lobe with a black spot, an orange spot on its inner side and some white hairs above it; tail black, tipped white. *Cilia* of lobe black with a white middle line; rest of *cilia* of both wings black with pale tips. *Underside*: both wings buff-grey, markings a little darker than the ground colour, very fine and usually faint. Fore wing with a double line, with a pale line between at the end of the cell; a slightly sinuous, discal line, outwardly edged with white, slightly outwardly-curved, from near the costa to near the sub-median vein; a sub-marginal line of disconnected lunules, outwardly edged with white; the hinder marginal space pale. Hind wing with similar discoidal and discal lines, the former edged on both sides with white, the latter well separated from it, slightly outwardly-curved from the costa to vein 2, then curved inwards in a long loop to the abdominal margin a little above the anal angle, where it is white-edged on both sides; a submarginal, indistinct band; anal angle black, lined with white above and below it: a smaller black spot in the first interspace, capped with orange; a terminal, black, fine line which becomes obsolete upwards; and a fine, anteciliary thread from the lobe to vein 2. Antennæ black, ringed with white; club with a red tip; frons ochreous with a brownish, middle stripe; eyes ringed with white; head and body above and below concolorous with the wings, abdomen below ochreous. Female. *Upperside*: paler than male, with a purplish gloss; the colour darkening; with blackish-brown, rather broad bands on the margins of fore wing, broadest at apex. *Underside*: as in male. Expanse: 29-37mm.

Larva.—This is one of the abnormal larvæ of the family; it is unlike any other known one outside the genus. The body is nearly parallel sided and trapeze-shaped in transverse section, the longest side being the closely applied ventral surface, the shortest the dorsal; and this because of the existence on segments 4-10 of a row of subdorsal and dorsoventral teeth or tubercles (*vide* Pl. II, fig. 24), the anal segments with six teeth round the circumference and rather flat. *Head* round, hidden, translucent-looking yellowish greeny-white in colour with a black suffusion about the mouth-opening and a white labrum, mandibles reddish, clypeus triangular with the marginal line soiled; segment 2 nearly semicircular in shape, convex transversely, more or less quarter-spherical in shape the dorsal depression being hardly existent and convex, white enamel-looking; or yellowish; segment 3 is particularly short (as are also 4, 5) and segments 3-10 bear, each one, a subdorsal (might be called dorsolateral, perhaps, more correctly), fleshy, conical tooth with a very shortly-cylindrical top, broad at base, erect, about half a millimetre in length or more—as long as the segment perhaps—and all of equal length; there is besides, on the same segments, a dorsolateral, similar tooth or tubercle; segments 11, 12, 14 have each a dorsoventral tooth only, the first two pointing up and slightly back, the anal pair directly back: and no dorsolateral ones; the dorsolateral teeth of segment 3 are more or less on the front margin and are connected over the dorsum by a ridge; the dorsolateral teeth of segment 4 are just behind the front margin and also connected by a ridge; segment 4 is the highest point of the dorsum and thence backwards to segment 11 is the same height; the last segments sloping to end, 12 being dorsally flat, this flat part short-parabolic in outline; the free margin separating the anal teeth a straight line. *Surface* of larva covered with sparse, minute, erect, dark hairs; anal segment margin as well as the front margin of segment 2 set with longish, fine, white hairs; the teeth or tubercles clothed with semi-appressed, brown, very minute bristles and surmounted by 3 or 4 longish, black bristles; gland on segment 11 large, mouth-shaped and transverse, rather widely open, situated on the top of a tumidity and surrounded by some black, bristle-bearing, minute tubercles; the organs of segment 12 are circular-mouthed, small, emitting small, cylindrical, white tubes. *Spiracles* of ordinary size, oval, brown, situated above the dorsoventral teeth. *Colour* of the larva is green; the cylindrical portion of the teeth translucent-looking except on segment 5 where they are black; bases of dorsoventral teeth touched with brown; a diagonal white line curving from hinder margin of the segment at the base of the dorsolateral tooth round the outside of it and up to dorsal line on front margin of each segment 3-10; the dorsal space inside these diagonal lines suffused with brown; segment 11 with three parallel, short white lines anterior to the gland, longitudinal and connected by a short, transverse, white line along front margin; a yellowish subspiracular line running over the dorsolateral teeth, ventrum light translucent green—the sides being set with longish, white hairs. L: 19mm; B: 6·25mm.

Pupa. (Pl. II, fig. 24 *a*)—Normal in *shape* but with the constriction very shallow and wide; stout. *Head* hidden under segment 2, very considerably bowed towards ventrum; segment 2, transversely convex, long, the dorsal slope at 60° to the longitudinal axis of the pupa, hinder margin rather convex towards thorax; thorax humped, the front dorsal slope 60° in continuation of that of segment 2, gradually becoming parallel to the longitudinal axis about apex and then descending gently to segment 5, compressed somewhat lateral; the shoulders much broader than segment 2; the lateral outline thence to segment 7/8 slightly concave, the dorsal also; abdomen stout and as high as the thoracic apex at segment 7 and broader than shoulders at 7/8; anal end somewhat turned under: the hinder end of pupa, therefore, broadly rounded; the transverse section of the abdomen is circular except for the somewhat flattened ventrum. *Surface* of pupa finely aciculate-reticulate covered with minute, erect, red hairs which are longest on the two extremities and with a slight, circular depression above each spiracle of abdomen-scars of the dorsolateral teeth? The intersegmental membrane between segments 9, 10 is visible, black and finely striate, the posterior margin of segment 9 very slightly raised above 8. *Spiracles* of segment 2 facing forwards, oval, white, flat; the others situated in shallow depressions, oval: light brown, oval with a middle slit. *Colour* brown-rose, smudged with blackish on the sides of thorax and on wings, leaving a diamond-shaped space of the ground-colour on the apex of thorax pure; blackish, lateral, smudged abdominal, line. L: 12 mm.; B: 6 mm; H: 5·25 mm.

Habits.—The egg is laid amongst the flowers, the larva lives nearly entirely on them, indeed entirely; and is attended by a *Cremastogaster* ant; is sluggish, grows rapidly; turns rose before pupating; pupates anywhere, wandering prior to settling down; often goes down to the ground to change and undergoes the transformation on a leaf, in a crevice, on a stone &c. The pupa is attached by the tail and a body-band. When touched it makes a noise like fluttering which is distinctly audible; probably it makes it by moving the abdominal segments together at the common margin of segments 8, 9, and that might be the reason why the segmental membrane is there exposed. The butterfly is a strong and rapid flier and does not bask on the tops of trees but sits on the lower branches generally with the wings closed, doing nothing in particular as far as can be seen—it occasionally darts after another insect. *The* place to find them and catch them is at flowers for they are very greedy of nectar and may be found at them even in really dull weather, one of the favourites being the sapindaceous *Allophyllus Cobbe.* The flight is straight. The habitat of this insect is India, Ceylon, Andaman Islands. It frequents open plain country as well as jungles and regions of forest, hills and heavy rainfall in Sikkim; Khasis, Ranchi, Calcutta, Dharwar, Thana, Karwar, Central Provinces, Chin Lushai, Massuri, Lucknow, Matheran, Cachar, Nilgiris. The foodplants of the larva are *Spiræa sortifolia* (*Rosaceæ*) in the Himalayas; *Antidesma ghæsembilla* (*Euphorbiaceæ*); *Zizyphus* (*Rhamnaceæ*); *Acacia pennata* (*Leguminoseæ*); *Quisqualis indica* (*Combretaceæ*); and nearly always it is the flowers that are eaten.

193. Rapala varuna, Wood Mason and de Nicèville. Male. *Upperside*. dark indigo-blue, glossed, in certain lights with a greenish tint. Fore wing: with a blue colour merging into the broad, black costal and outer, marginal borders. Hind wing: with the costal space and abdominal fold blackish, outer margin with a very narrow black band; the abdominal space outside the fold darker black than the colour of the fold; anal lobe black, with an orange spot, and a few greyish-white scales along its upper side; tail black, tipped with white. *Cilia* of both wings black with pale tips, with a white medial line through it from the anal lobe to vein 3. *Underside* rufous-brown, varying in shade of colour somewhat in different examples; markings darker brown. Fore wing: with a bar at the end of the cell; a moderately broad, discal band from near the costa to the submedian vein, slightly outwardly curved above its middle, in some examples with a patch of black suffusion joining it to the discal bar; a submarginal, narrower band. Hind wing: with similar discoidal and discal bands, the latter outwardly edged with white, composed of conjoined, squarish, spots, passing close to the lower end of the discoidal bar, slightly outwardly curved from the costa to vein 2, where it curves inwards in a large angle to the abdominal margin a little below its middle, and is there prominently edged with white on both sides and has a short, white line close below it; anal lobe black, crowned with dull orange; a white, anteciliary thread on the lower half of the outer margin. Antennæ black, ringed with white; club tipped with red; frons black; eyes ringed with white; head and body above and below concolorous with the wings, abdomen below ochreous.—Female. *Upperside* paler, pale brown glossed with purple; consequently the costal and outer marginal black borders more distinct. *Underside* paler than the male, markings similar. Expanse: 27—40 mm.

Larva.—It is of the same *shape* exactly as others of the genus; that is of the lycænid form generally but with a row of dorsolateral and subspiracular (dorsoventral) teeth or short, cylindrical, fleshy protruberances topping broadly conical productions or risings of the larval surface. Each segment 3-10 has these; segment 2 is normal with the usual four-sided, dorsal depression; segments 11-14 (segment 13 is entirely wanting or, at least, not traceable) are without the dorsolateral teeth and the subspiracular ones are situated slightly higher than those of the rest of the segments, those on segment 11 pointing slightly up, those on segment 12 slightly up and back, those of the anal segment straight out and back, diverging slightly from each other and separated broadly at their bases by the perfectly straight hinder margin of the segment, the distance between the bases being well over the length of the tooth. The dorsal depression of segment 2 is smooth and shining, has the margins slightly waved and is more or less the colour of the rest of the body with a pure white, dorsal line as well as a similar line at right angles to it, the two forming a white cross; the segment itself is tumid as usual, semicircular in shape. Segment 3 has the front margin straight and rising perpendicularly from segment 2, the teeth being situated there, the rest of the segment sloping back and slightly down to the hinder margin; all the other segments 4-10 rise suddenly, *i.e.*, in a steep slope to the top of a rather narrow, round-topped ridge behind the middle of each, which ridge bears the dorsolateral and subspiracular tooth on each side of the dorsal line where it (the ridge) is largely dented between the two dorsolateral risings; behind the ridge the segments fall nearly perpendicularly to the hinder margin; also, laterally on each, the whole surface is slightly concave between the dorsolateral and subspiracular teeth on the front slope of the ridge. Segment 11 bears the mouth-shaped, transverse gland on the crest of the ridge; segments 12 and 14 are more or less flat dorsally between the subspiracular teeth and the former bears the usual protrusible organs which are small and often difficult to trace. *Head* round, shining, light watery greenish-white suffused at eyes and round the mouth-opening with dark red-brown: the labrum and antennæ whitish; the clypeus is large, triangular, outlined thinly red-brown. *Surface* shining, covered with a few ordinary, minute, lowly convex tubercles and short, black hairs; the teeth set with short, black, radiating hairs: the front margin of segment 2 with a good many light, fine, erect hairs all over it, some of them very nearly as long as the segment itself (three or four only); some very much shorter hairs on the hinder margin of segment 14; the hairs on the "teeth" are as long as the teeth proper themselves (not counting the great conical surface-risings which might be looked upon as their bases). *Spiracles* small, rather light pinkish-brownish, slightly prominent, dullish, very regular-oval; those of segment 12 larger than the rest. *Colour* is perhaps, generally, apple-green but the whole is more or less suffused throughout with brown-rose; on each segment is a white line starting subdorsal at the front margin and running down and back to the hinder margin just above and behind the spiracle; the dorsal region lighter; the cylindrical teeth nearly white (a sort of livid, soiled-looking yellowish-white); the tops or crests of the ridges also lighter;

the ventrum, legs and prolegs all a light, very pale, watery green. L : 15 mm. ; B : 7·5 mm. including the teeth and about 5 mm. excluding them.

The colouring is difficult to describe as it is so patchy. There is a touch of yellow behind each spiracle ; the spiracles are situated upon the posterior slopes of the ridges ; the flat-dorsal surface of segments 12-14 is somewhat corrugated.

Pupa.—This is more or less normal in *shape* but very stout in build. It is highest at segment 7 and there also broadest ; the front end is comparatively narrowly rounded, the anal end very broadly as segments 10-14 have their dorsal line more or less in a plane perpendicular to the longitudinal axis of the pupa ; segment 9` has it inclined at about an angle of 45° ; the dorsal line of thorax slopes towards head from the hinder margin in a more or less even, slightly convex line ; the *head* is nearly altogether ventral, the front margin of segment 2 forming the front of the pupa ; the shoulders are rounded and hardly prominent ; there is a slight wide constriction from them to segment 7 laterally ; dorsally also, segments 4, 5 are at a lower level than either the thorax or segment 6. Segment 2 is hood-shaped, more or less in the shape of a quarter-sphere but slightly flattened in the dorsal region along the front margin (which is practically in the same plane as the straight ventral line) and very slightly compressed laterally, the dorsal line at an angle of 73° to the longitudinal axis, the hinder margin very nealy straight between the spiracles ; the thorax is twice the length of segment 2 (perhaps a little more) and, like it, transversely convex, rising from the front margin in the same plane as it also but soon curving round to become nearly parallel to the ventral line or longitudinal axis (which is, here, the same thing), at the extreme hinder margin it falls gently, the hinder margin is produced backwards in a right angle into segment 4, and each end of this hinder margin meets the wing-line in a widely open, broadly rounded angle of slightly under 90° ; segment 4 is very short in the dorsal line, somewhat extensive laterally ; segment 5 is shorter than the dorsal line of segment 4 ; segments 6-9 inclusive are more than three times as long as 5 and coequal ; segment 10 the same as these ; segments 11, 12 half as long as them ; segments 13, 14 together (segment 13 practically non-existent) as long as 12. *Surface* of the pupa is rugose with fine, raised, thin reticulations which are more or less in the form of rays from small, raised points and this is the case all over except in the broad spiracular depressions where there are merely tiny tubercular risings without reticulations ; the hinder margin of segment 9 and the front margin of segment 10 is conspicuously thickened and raised, the former more than the latter—with a narrow depressed interval between ; segments 10, 11 similar but less so ; the whole surface set with short, erect, light brown, pointed, minutely feathered hairs which are longest and densest on segment 2 along the front margin and on the three last anal segments, (12-14); these hairs as long as the spiracles : the longer ones as long nearly as the spiracles of segment 2. *Spiracles* of segment 2 are nearly as long as segment 5 and less than half that breadth, oval, facing forwards and very light pink-brown in colour; the rest are very small, oval, slightly raised, shining and the same colour, each one in a broad, shallow depression of the surface ; that of segment 11 blind, of segment 12 still blinder. The *colour* is moderately dark brownish pink suffused dorsally and laterally on the abdomen irregularly with brown, on the thorax laterally ; the wings yellowish suffused thickly with brown or olive-brown. L : 11· 5mm. ; B : 6mm. at segment 7, 4mm. just before shoulders ; the heights at those places the same.

Habits.—The egg is laid in the axil of a flower-bud or on the stalk of a flower; nearly always amongst the flowering parts. Never more than one is deposited at a time. The little larva eats its way out of the side of the egg towards the top and is at first more or less like other lycænid larvæ. However, after the first moult it begins to show the "teeth" of the mature stage. It bores into the flower-bud when very small and feeds on the tender parts of the inside. As it grows bigger, however, it takes to eating the rest of the flower parts and even the young leaves. It is at all times sluggish and is sometimes attended by ants of various sorts. Before pupation it becomes a dark brownish-pink in colour and wanders away to some crevice or secluded, darkish place where it fixes itself down with a body-band and tail-attachment. When touched it emits a knocking noise by moving the body from segment 9/10 forwards: it moves it up and down, though very slightly. The larva, when not feeding, retires to branches or the trunk of the tree and hides itself in the crevices of the bark or similar places. The habits of the butterfly are identical with those of *Rapala schistacea* in every way and the caterpillar feeds on the flowers of *Zizyphus xylopyrus*, *Z. rugosa* (*Rhamnaceæ*); *Quisqualis indica* (*Combretaceæ*): *Sapindus trifoliatus* (*Sapindaceæ*) and, doubtless, many others. The habitat of the butterfly : is throughout India, Burma, Ceylon, Java and Borneo, in the plains and hills, in forests or open country, from sea-level up to 3000′ at least and practically everywhere except in desert country where rainfall is deficient. Specimens have been taken in Calcutta, Karen, Chin Lushai and Chin Hills, Masuri, Lucknow, Matheran, Thana, Belgaum, Dharwar and Kanara Districts in Bombay; Java; Port Blair in the Andamans.

37. Genus CHERITRA.

The genus contains but two species, one with the underside pure white, the other with it washed with ferruginous; both with a long, feathery white tail at the end of vein 2 which is as long as the whole costal margin of the fore wing; another, not a quarter the length, at the end of vein 1 and a short apology for one at vein 3. Eyes naked; body moderately robust; palpi pointing straight forwards, second joint long and roughly scaled, reaching for half its length beyond the head, the third one-fourth the length of the second, slender; the palpi of the female much longer than in the male. Antennæ gradually thickened to end, tip pointed. The transformation of *jaffra* are known and are given below. The larva is abnormal, somwhat the shape of that of *Rathinda* but with only short, dorsal, hooked teeth instead of long tentacular processes. The pupa is stouter than that of *Rathinda* but much of the same type and is attached only by the tail. The larva is practically omnivorous in the matter of foodplants. The genus inhabits North East India in the Himalayas; South India; Ceylon; Burma; the Malay Peninsula and some of the Malay islands.

194. Cheritra jaffra, Butler.—Male. *Upperside* : both wings : blackish-brown, covered with a beautiful purplish gloss. Fore wing: immaculate. Hind wing with the anal extremity of the outer margin black separated off from the rest of the wing by a straight, white boundary often composed of two separated lunules, the outer opposite the 18mm. long tail at the end of vein 2, the inner opposite the space between the long tail and the inner tail; the black extremity also bordered below by white from the anal angle as far as the base of the long tail; a short white line inside this latter white mark at the extreme margin indicating the interior attachment of a small, brush-like appendage. *Underside* : both wings pure white with a slight lustre, the apex somewhat broadly and outer margin tinged with brown ; a delicate, brown line on the discocellular veins ; a complete postmedial line composed of interrupted, short lines between the veins ;the two in interspaces 4, 5 moved outwards ; a very obsolete submarginal, similar line. Hind wing : with a postmedial similar line to that on the fore wing but inside it and not continuous with it, composed of similar lunules from the costa to vein 4, then of much more arcuate marks curving round to the middle of the anal margin ; a similar submarginal series from costa to anal margin parallel to the postmedial line ; outside this again a series of four deep-black spots, marginal, from the interspace 3 to anal lobe inclusive ; the uppermost and last but one generally much smaller than the other two. *Cilia* of fore wing brown, of hind wing white.--Female. Exactly like the male except that the white, transverse bands above the tails on the upperside of the hind wing are far broader and there is no purplish gloss. Antennæ black with a few white scale below ; head, palpi, thorax and abdomen brown above, white beneath ; the eyes bordered with white and vertex of head with a white central line. Expanse : male and female, 40mm.

Very rarely specimens are found with a white, discal patch on the fore wing in the Kanara District. About half a dozen insects of the same brood were bred bearing this patch.

Egg.—Nearly hemispherical in shape, broadest just above the base ; the surface covered with seven rows of coarse-walled cells, irregular in contour, from summit to base ; shining. The colour is enamel-white. L : 1. 5mm : B : 1mm.

Larva. (Pl. II, fig. 25).—The *shape* is that of the larva of *Rathinda* but it differs in having a dorsal ecries of short, rather hooked, fleshy teeth on segments 5—10 instead of the tentacular processes described for that genus

The *head* is shining light-yellow in colour, rather small, round and is hidden under segment 2. Segment 2 rounded along the free margin, somewhat narrowly indented in the dorsal line of front margin and, again, laterally with a small, rounded sinus, the margin somewhat thickened ; anal segment square behind at the extremity ; segments 11, 12 broadened out at their common margin into a sort of triangular, rounded tooth on each side so that the body is little narrower across there than it is at the broadest part, segment 5 ; segment 11 has the gland situated on a transversely swollen fold near the hinder margin. The body is considerably broadened out a segment 5 gradually increasing in width and evenly, from the front, then narrowing again as evenly though more gradually to segment 10, increasing much more rapidly to the tooth at the common margin of segments 11/12, thence narrowing to the extremity ; the dorsal outline is more or less straight from the anterior end at head up to the top of segment 5, sloping at about 45° when the larva is at rest with the head tucked in and the front segments somewhat contracted, then convex over the top of segment 5, after which, with a slight concave curve it runs down to segments 11/12, thence sloping much more rapidly for the short distance to the end ; the ventrum is quite flat and closely applied to the surface ; the dorsal outline, further, toothed on segments 5 to 10 by one single, 1mm. long (barely that), hooked, laterally compressed, sharp, broad-based, fleshy tooth in the middle ; the first four directed somewhat slantingly backwards, that on segment 9 quite vertical, that on segment 10 slanting forwards. The *surface* is shining, pitted minutely all over, laterally indented at the base of each dorsal tooth (or only at teeth of segments 8-10), covered besides with appressed hairs all over which are somewhat irregularly directed, white-colourless and very small; also similar hairs on the dorsoventral margin but mixed with a few, comparatively long, brown, erect hairs—the minute hairs on the brown parts are brown. *Spiracles* of ordinary size, oval, light in colour, narrowly bordered brown. *Colour* of the larva is green or rose according to whether it is feeding on green or red young leaves; generally with a lighter colour dorsally on segments 3—6; segments 8, 9 are always brown; the teeth are tipped yellow (if the colour is rose) and brown (if green); there is a greenish (if rose) or white (if green) subspiracular line. L: 19mm.

Pupa. (Pl. II, fig. 25*a*).—It is also of the same *type* as that of *Rathinda amor*: fixed by the tail only and standing free. *Head* bowed, hidden from above by segment 2; segment 2 rounded as to the free margin, convex dorsally and transversely, sloping in the dorsal line at a considerable angle towards thorax; thorax large, stout, very convex-humped; constriction behind it dorsally slight, laterally nil; abdomen swollen at common margin—or about there—of segments 6, 7, being highest part of the pupa; and that region is also the broadest part, broader somewhat than at shoulders; the dorsal slope from 6/7 to the anal extremity is at an angle of about 45° to the surface the pupa is fixed to, assuming that that surface is all in the same plane; the anal segment hoof-shaped; ventral line more or less straight though slightly curved concavely. *Surface* dull, finely rough, no clothing; the segments distinct. *Spiracles* of segment 2 raised, white in colour and longly oval in shape; the rest small, longly oval, flush and brown. *Colour* of pupa:—head, thorax and wings brownish-grey, the colour of the bark of young shoots; eyes bright-green; abdomen bright-green with a long, dorsal oval space on segments 6-10 which is brownish-grey. L: 10mm.

Habits.—The eggs are laid, three or four in fairly rapid succession on the shoot or stalk of the young leaf; the larva, emerging, lives openly on the underside of a leaf or on a leaf-bud or stalk. Later on, when it gets big, it is easy to see as it always feeds on the young leaves throughout its existence and is a conspicuous object, feeding on the edges from below; also, there are almost invariably, several together, *i. e.*, on the same leaf, if large, or on separate leaves of the same bunch. The pupa is formed on a stalk or twig amongst the shoots, on a tree-trunk, the surface of a rock, &c.; and the head is invariably directed upwards. The butterfly is very plentiful in the North Kanara District of Bombay, in Belgaum and along the Ghats also; and is, besides, very easy to see, attracting attention by its long feathery tails as it flies or sits. It may be found flying about young shoots almost at any time during the day in the wet months in the opener places of the jungles where there have been cuttings or hacking of branches; it flutters a good deal round these, often flying off a space to return again; but will also fly along pretty straight and strongly along the edges of these clearings and frequently rises to the tops of the trees. It basks sometimes quite low down on a leaf with the wings half opened, at others it chooses a higher perch; it rests on the undersides of leaves, on a twig, &c., with the wings closed completely held over the back in the usual way. It exists from sea-level to 2,500′—the highest parts that Kanara can boast of but never seems to go into the absolutely open fields nor to extend further than where the rainfall is less than about 30″. The larva is not attended by ants as a rule but, occasionally, these insects may be found on the young leaves with them although, it seems, not with the primary intention of visiting them. The eggs are laid, as a rule, many on one plant, on the young shoots in the axils of leaves and on buds. Some of the foodplants are Cinnamon, *Xylia dolabriformis*, *Saraca indica*(both these last *Leguminoseæ*) and, doubtless, there are others. Cinnamon belongs to the laurels or *Lauraceæ*. The places from which the insect has been recorded are: Southern India and Ceylon. There is another form, formerly considered to be a separate species but now regarded as a race only, *C. freja*, Fabricius, the originally described form from North India, which exactly resembles *jaffra* except that the undersides are washed with ferruginous. That race exists in the Himalayas; Assam; Burma; Malay Peninsula, Java and Borneo.

38. Genus—BINDAHARA

Eyes hairy; body moderately stout; palpi directed straight forward (twice as long in the female as in the male), second joint scaly, very long, extending two-thirds beyond the head, third joint one-third its length, slender, naked; legs scaled, femors slightly hairy beneath; antennæ with a lengthened, pointed club. There are two species and a more or less constant race recognized in India: *phocides* from Himalayas in Bhutan, Sikkim, Sylhet, Burma, South Andamans, Malay Peninsula and Nias Island; *areca* from the Nicobars; and our one, *sugriva* from South India, Ceylon and Java. This last is easily recognized by its pure velvety black uppersides with long cream-coloured or light coffee-coloured tails, as long as, and very similar to, the white ones of *Cheritra jaffra*, with a bright metallic-blue, short band above them in the male; the female is brown and rather similar to the female of *Cheritra jaffra* but easily distinguishable from it by the banded underside which is the same in both sexes; the anal lobe of the hind wing is oblong and elongated. *Sugriva* is common in the jungles of the Western Ghats in Kanara District and is fond of flowers, especially those of *Leea*. The larva is very like those of the genera *Deudorix* and *Virachola*, having the same peculiar formation of the last three segments to form a shovel for cleaning out the fruits in which it lives and which it eats. The butterfly flies fast and well and keeps to the tops of high trees but does not come out into the open. The pupa is also similar to those of those genera.

195. Bindahara sugriva, Horsfield. Male.—*Upperside*: both wings black. Fore wing: with the extreme costal nervure yellowish and marked near the apex with three delicate, oblique, black lines. Hind wing: narrow, gradually tapering to the anal extremity, with a single marginal notch near the base of the tail; where starts a broad, short, metallic-blue, marginal band, varying in tint according to the light, terminating at a small distance above the anal angle; abdominal margin brown from the base to the middle, then greyish-yellow, in the anal region orange extending to the extremity of the tail; there are two black lunules in the anal region, one exterior near the marginal notch, one at the base of the tail, both of them very faint. *Underside*: both wings ochraceous-brown becoming pure yellow towards base with the spots and bands of a deeper colour bordered throughout with a delicate, yellow line. Fore wing: bearing an oblong spot near the base, and three, broad, transverse bands; the first, at a small distance from the base, abruptly terminated at the costal vein; the next, postdiscal, extending across the whole wing, thinning downwards and tending slightly towards the outer angle, with an irregularly-waved, posterior margin: the third, somewhat narrower, submarginal, also extends right across the wing. Hind wing: an oval spot near base near the costa; then a broad irregularly-interrupted, subbasal, arched band, composed of, near the costa, subconfluent marks, on the disc and near the inner angle of several successive pairs of distinct, oval spots; postmedially: a series of brown arcs margined with yellow forming a curved band right across the wing, being simple near the exterior margin but consisting of a double series of parallel, darker coloured arcs as they approach the inner margin; beyond this a delicate, brown, submarginal thread, flexuose across the entire wing; forming the inner boundary of a marginal series of oblong spots containing, in the anal region, two deep-black ocelli, one on each side of the tail, an oblong similar spot on the lobe; all these black spots adorned, each, at the internal edge, by a delicate, powdered greenish-silvery streak. Body black above, white-downy beneath. Antennæ black with a ferruginous tip, sprinkled snow-white underneath to base of club. Tail uniformly deep cream coloured. Female. *Upperside*: both wings olive-brown, in some lights glossy metallic-brown. Hind wing: with the anal area and the tail white; a large, black spot at the outer base of tail and a black-speckled spot at the anal lobe. *Underside*: both wings white, marked as in the male. Expanse: male: 35-40mm; female: 30-40mm.

Egg.—Dome-shaped, broadest just above the base. *Surface* shining; covered with thick-walled cells which are 4-and 5-sided, the first two rows above the base more or less regular—oblong with their greatest length along the meridians; the intersections of the walls are thickened and slightly prominent; all the cells are more or less irregular-shaped and diminish in size upwards; there are about three rows of large cells from just above the base upwards; then, further up, they get small, the walls get thin and only the intersections are prominent: little, white lumps; the centre or apex is occupied by an annular depression immediately around which the cells are minute. *Colour*: blue-green; the cell-walls and lumps all white. B: 0.9mm; H: 0.6mm.

Larva.—Is in shape, etc., nearly exactly like that of *V. isocrates* to look at except that the white mark on segments 7, 8 is here cream-colour. *Head* shining, round, red-brown in colour, the eye-batch black. Segment 2 is semicircular in outline, the central, dorsal depression shining with a large black spot at each lateral angle; the arrangement of the last three segments 12-14 is the same as in *V. isocrates*. *Surface* very shining, covered closely with minute, erect bristles; these bristles longest on the sides and front margins of segments 2, 3 on the dorsoventral margins and round the edges of the "shovel"; gland on segment 12 inconspicuous, transverse, mouth-shaped. *Spiracles*: black, oval, situated in depressions, raised, conspicuous. *Colour* of body very dark purple-brown; segments 2, 3 orange, except that 3 has a lateral patch of body-colour and a dorsal line of the same, segments 7, 8 creamy-white with a small, dorsal and lateral patch of body-colour; ventrum orange. L: 20 mm; B: 6 mm; H: 5 mm.

Pupa.—Very similar to that of *V. isocrates. Head* ventral, the front margin of segment 2 starting from the resting-surface, absolutely semicircular in outline, convex transversely, dorsal slope of segment 2 and the front ascent of thorax in a plane at about 60° to the longitudinal axis of pupa; thorax convex and even with segment 2 but broader; shoulders rounded; greatest breadth at segments 7/8; the construction very slight; transverse section of abdomen a slightly depressed circle. *Surface* of pupa finely aciculate-reticulate on segments 2, 3; with semi-erect, fine, white hairs on the whole surface except wings and sides; also covered with minute, brown tubercles. *Spiracles* of segment 2 nearly linear, longly oval, slightly raised and facing forwards; others longish oval, brown in colour. *Colour*: lightish yellow-brown; blotched darker on sides of segments 2, 3. L: 11·75 mm; B: 5 mm. H. 4·75 mm.

Habits.—The habits are nearly the same, for the larva and pupa, as those of *Virachola isocrates*. The larva is only intermittently visited by ants; not really attended by them. The eggs are laid on the fruits, whether ripe or green but always when fairly well-grown; on the branches, twigs, leaves, &c. The larva, however, does not fix the fruits up with a web and change into the pupa sometimes when they have fallen to the ground; ordinarily, however, they leave them and pupate anywhere else. Neither do the larvæ spin a hinged door to the entrance of the fruit when they pupate inside it. The pupa is attached by the tail and a body-band in the usual way. The butterfly is a strong flier but not so quick or active as *Deudorix* or *Virachola*. The male is much oftener seen than the female as the latter does not visit flowers nearly as much. She probably attends to business while the other, as usual, prefers leading an idle, luxurious existence. The flower that seems to attract the males most is that of *Leea sambucina* in Kanara. They are easy to catch when sitting on the flower-heads but it is not usual to get a good specimen for they seem to batter themselves about a good deal, especially their long, feathery tails. It is rare to get a perfect specimen except a cage-bred one. Ordinarily the insect must live amongst the upper stories of the forests for, except at flowers, it is rarely seen. It certainly does not go to the summits of the hills to bask on the tops of trees for the writer has never seen one in such places although other butterflies go up in numbers for the purpose. The foodplant of the larva is *Salacia macrosperma* of the order *Rhamneæ*, a somewhat extensive creeper of common occurrence in the heavy evergreen and semi-evergreen forests of Kanara. The fruits, which are the only part eaten, are round, about 1″-1·5″ in diameter, wrinkled-rough on the surface and bright orange in colour. They ripen in the monsoon months and may then be found strewn about on the ground in the jungles, most of them having the insides eaten out of them by monkeys. It is an easy matter to climb up and get as many as are wanted from the branches and nearly every fourth or fifth one is sure to contain a larva or two, if not even three. Sometimes as many as five eggs will be found on the stalks and fruit-surface and these can be bred out without difficulty. Many of the eggs are parasitised—and perhaps it is as well, for there seems to be a superabundance of them and the females must be extremely prolific. The habitat of *Bindahara sugriva* is South India, Ceylon and Java. It is certainly a purely jungle insect and never occurs anywhere even near the eastern border of the forests of the Western Ghats where the rainfall is probably deficient. It is plentiful on the hills near Karwar in Kanara close to the sea—within a mile or so of the actual sands—and is sure to occur also at Mahableshwar and all along the evergreen parts of the western ghats up to Matheran.

(*To be continued.*)

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY

OF THE

BOMBAY NATURAL HISTORY SOCIETY.

By R. C. Wroughton, F. Z. S.

Part V.

(*Continued from page 802 of Volume XXVI.*)

Gen. XI.—Leggadilla.

Thomas established the genus to accommodate the species *platythrix*, Benn., (J. B. N. H. S., xxii, p. 682, 1914).

No. 289. *platythrix*, Benn.

A large number of names has been added comparatively recently, of which the following is a chronological list (with references), *viz*:—

1832. *platythrix*, Bennett, P. Z. S., p. 121.
1908. *ramnadensis*, Benth., Rec. Ind. Mus. ii, p. 385.
1911. *sadhu*, Wr., J. B. N. H. S. xx, p. 1001.
1912. *cinderella*, Wr., J. B. N. H. S. xxi, p. 770.
1912. *phillipsi*, Wr., J. B. N. H. S. xxi, p. 772.
1913. *surkha*, Wr. and Ryl., J. B. N. H. S. xxii, p. 16.
1913. *bahadur*, Wr. and Ryl., J. B. N. H. S. xxii, p. 18.
1913. *siva*, Thos. and Ryl., J. B. N. H. S. xxii, p. 242.
1913. *grahami*, Ryl., J. B. N. H. S. xxii, p. 434.
1913. *hannyngtoni*, Ryl., J. B. N. H. S. xxii, p. 435.
1914. *shortridgei*, Thos., J. B. N. H. S. xxiii, p. 30.
1914. *gurkha*, Thos., J. B. N. H. S. xxiii, p. 200.

These twelve species may be arranged in a key as follows :—

Key to the species of Leggadilla.

A.—Mammary formula 4—2=12.
  a. Size large, hind-foot 22mm.; colour brown ... ... 1. *platythrix*, Benn.
  b. Size smaller, hind-foot 17mm.; or less; colour grey drab.
    a^1. Size larger, hind-foot 17mm., condylo-basal, length of skull 25mm.; upper molar series 4mm. 2. *sadhu*, Wr.
    b^1. Size smaller, hind-foot 16mm. at most; condylo-basal, length of skull 22mm.; upper molar series 4mm. ... ... 3. *cinderella*, Wr.

B.—Mammary formula 3—2=10.
  a. Size large, hind-foot 22mm.
    a^{1}. Undersurface whitish grey ... 4. *shortridgei*, Thos.
    b^{1}. Undersurface pure white.
      a^{2}. Coat composed of fine spines... 5. *hannyngtoni*, Ryl.
      b^{2}. Coat composed of coarse, harsh spines ... ... 6. *bahadur*, Wr. and Ryl.
  b. Size smaller, hind-foot 19mm., or less.
    a^{1}. Hind-foot about 18mm.
      a^{2}. Colour darker; a pinkish line dividing flank from underside. 7. *grahami*, Ryl.
      b^{2}. Colour paler; sharp line of demarcation between flank and pure white underside ... 8. *gurkha*, Thos.
    b^{1}. Hind-foot about 16mm. or less.
      a^{2}. Coat composed almost entirely of stiff spines.
        a^{3}. Colour darker, dark bistre ... 9. *phillipsi*, Wr
        b^{3}. Colour paler, fulvous drab ...10. *surkha*, Wr.&Ryl.
      b^{2}. Coat with much finer spines.
        a^{3}. Coat very close and short (3 mm.) ... ...11. *ramnadensis*, Benth.
        b^{3}. Coat fuller, hairs and spines longer (7-8mm.) ... ...12. *siva*, Thos. & Ryl.

DISTRIBUTION :—

1. *platythrix*, Bennett.	*Type locality* :—" Dukhun" (Sykes). *Other localities* :—Ahmednagar; Thana; Central Provinces; Dharwar (B. M.); Khandesh; Berars; Nimar; Central Provinces; Ratnagiri; Satara; Dharwar; Mysore (M. S. I.). *Type* :—B. M. No. 55.12.26.382. (in al.). (Type of *saxicola*, Elliot, B. M. No. 32. *d.*; Type of *spinulosa*, Blyth. Ind. Mus. Calc. No. *e.*
2. *L sadhu*, Wroughton.	*Type locality* :—Virawah, Sind (Priestley). *Other localities* :—Cutch; Kathiawar; Palanpur (M. S. I.). *Type* :—B. M. No. 11. 3. 13. 8.
3. *L. cinderella*, Wroughton.	*Type locality* :—Bhuj, Cutch. (B. N. H. S.—Crump). *Other localities* :—Cutch (M. S. I.) *Type* :—B. M. No. 12. 1. 9. 12.

4. *L. shortridgei*, Thomas. *Type locality* :—Mt. Burma (B. N. H. S.—Shortridge).
Other localities :—Mt. Popa (M. S. I.)
Type :—B. M. No. 14. 4. 3. 6.

5. *L. hannyngtoni*, Ryley. *Type locality* :—Makut, S. Coorg. (B. N. H. S.—Shortridge).
Other localities :—Coorg (M. S. I.).
Type :—B. M. No. 13. 6. 21. 2.

6. *L. bahadur*, Wroughton and Ryley. *Type locality* :—Karwar, Kanara. (B. N. H. S.).
Other localities :—Kanara (B. M.).
Type :—B. M. No. 12. 10. 16. 3.

7. *L. grahami*, Ryley. *Type locality* :—Wotekolli, 2,000′, S. Coorg (B. N. H. S.—Shortridge).
Other localities :—S. Coorg (M.S.I.).
Type :—B. M. No. 13. 6. 21. 1.

8. *L. gurkha*, Thomas. *Type locality* :—Jerna, Ramnagar, Kumaon (B. N. H. S.—Crump).
Other localities :—Kumaon; Behar (M. S. I.).
Type :—B. M. No. 14. 12. 1. 1.

9. *L. phillipsi*, Wroughton. *Type locality* :—Asirgarh, Central Provinces (B. N. H.—Crump).
Other localities :—Palanpur; Nimar Berars (M. S. I.).
Type :—B. M. No. 12. 3. 2. 1.

10. *L. surkha*, Wroughton and Ryley. *Type locality* :—Vijayanagar, Bellary (B. N. H. S.—Shortridge).
Other localities :—Bellary (M. S. I.).
Type :—B. M. No. 12.10.16.1.

11. *L. ramnadensis*, Bentham. *Type locality* :—Ramnad, Madura, Madras (Annandale).
Other localities :—Ramnad (Annandale) (B. M.).
Type :—Ind. Mus. Calc. No. ?

12. *L. siva*, Thomas & Ryley. *Type locality* :—Sivasamundram, S. Mysore (B. N. H. S.—Shortridge).
Other localities :—None.
Type :—B. M. No. 13. 2. 16. 1.

Gen. XII.—MUS.

Thomas has quite recently (J. B. N. H. S., xxvi, p. 117, 1918) still further restricted this genus to the house-mice proper. Though the difference is not strongly marked, the fact that all the species, other than the true house-mice, are found only in Asia and Africa, while the house-mice are primarily palæarctic (their presence, or more correctly their representation,in India being accounted for by their close commensalism with man) seems, as pointed out by Thomas, to be a valid reason for recognising them as natural groups.

No. 282. *musculus*, L.
No. 283. *bactrianus*, Bly.

The following names are available in this genus, arranged in order of seniority, *viz* :—

1845. *dubius*, Hodgson, A. M. N. H., xv, p. 268.—Nepal.
1845. *homourus*, Hodgson, l.c.—Nepal.
1845. *urbanus*, Hodgson, l.c.—Nepal.
1846. *bactrianus*, Blyth.—Kandahar.
1851. *æquicaudalis*, Horsfield, Catalogue, p. 143.
1852. *manei*, Kelaart, Prod. Zeyl., p. 64.—Ceylon.
1853. *gerbillinus*, Blyth, J. A. S. B., xxii, p. 410.—Pind Dadan Khan.
1853. *theobaldi*, Blyth, l.c., p. 583.—Salt Range, Punjab.
1859. *tytleri*, Blyth, J. A. S. B., xxviii, p. 296.—Dehra Dun.
1878. *kakhyensis*, Anderson, An. Zool. Res., p. 307.—Kakhyen Hills.
1878. *viculorum*, Anderson, l.c. p. 308.

In the present state of our knowledge of this group, I propose to recognise only three forms, *viz. :—musculus* as representing the actually imported stock; *bactrianus*, including *gerbillinus* and *theobaldi*, as representing the overlapping palæarctic forms; and *dubius*, the oldest name, including all the rest, and representing he old established forms of *musculus*.

Key to the forms of Mus.

A—Belly white ... ... 1. *bactrianus*, Bly.
B—Belly coloured.
  a. Belly bluish grey ... ... 2. *musculus*, L.
  b. Belly washed with ochraceous ... 3. *dubius*, Hodgs.

DISTRIBUTION :—

1. *M. bactrianus*, Blyth. *Type localiy* :—Kandahar (Hutton).

Other localities :—Quetta (B. M.); Jacobabad, Sind (M. S. I.).

Co-types :—B. M. Nos. 56.2.29.3. & 4. (Type of *gerbillinus*, Blyth, Ind. Mus. Calc. No. *d.*; Type of *theobaldi*, Blyth, Ind. Mus. Calc. Nos. *d*—*f*).

Lectotype :—B. M. No. 56.2.29.3.

2. *M. musculus*, Linnæus. *Type locality* :—Upsala, Sweden.

Other localities :—Imported specimens only found in India.

Type :—Unknown.

3. *M. dubius*, Hodgson.

Type locality :—Nepal (Hodgson).

Other localities :—Hazara ; Kashmir ; Delhi ; United Provinces ; Ajmer ; Jetpur ; Ahmednagar; Thana; Nilgiris (B. M.) ; Kathiawar ; Palanpur ; Satara ; Dharwar ; Kanara ; Bellary ; Mysore ; Coorg ; Ceylon ; Kumaon ; Rohilkund ; Behar ; Sikkim ; Darjeeling ; Bhutan Duars ; Chindwin; Mt. Popa ; Shan States (M. S. I.).

Type :—B. M. No. 79.11.21.405. (Type of *homourus*, Hodgs. B. M. No. 79.11.21.406 ; Co-types of *urbanus*, Hodgson, B.M. Nos. 45.1.8.398—400. Lectotype, B. M. No. 45.1.8.398 (in al.) ; Type of *æquicaudalis*, Horsefield, not traced ; Type of *manei*, Kelaart, not traced ; Type of *tytleri*, Blyth, not traced ; Type of *kakhyensis*, Blyth, Ind. Mus. Calc. j^4. ; Type of *viculorum*, Anderson, Ind. Mus. Calc. No. k^1.—l^4).

Gen. XIII.—LEGGADA.

When restricting MUS to the house-mice, as explained above, Thomas revived this genus (genotype *L. booduga*) for the wild or field mice (perhaps jungle-mice would be a better name).

No. 285. *nitidulus*, Bly.
No. 287. *booduga*, Gr.
No 288. *cervicolor*, Hodgs.

The following names, arranged in order of seniority, are available in this genus, *viz.* :—

1837. *booduga*, Gray. Ch. B. N. H. i., p. 586.—Southern Mahratha Country.
1839. *lepidus*, Elliot, Madr. J. L. S. x, p. 216.—S. M. Country.
1845. *cervilcolor*, Hodgs. A. M. N. H. xv, p. 268.—Nepal.
1845. *strophiatus*, Hodgs. l. c.—Nepal.
1851. *terricolor*, Bly. J. A. S. B. xx, p. 172.—S. India.
1851. *darjilingensis*, Horsf. Catalogue, p. 143.—Trincomali.
1852. *fulvidiventris*, Bly. J. A. S. B. xxi, p. 351.—Trincomali.
1852. *albidiventris*, Bly. l. c.—Calcutta.
1855. *cunicularis*, Bly. J. A. S. xxiv, p. 721.—Cherrapunji.
1859. *nitidulus*, Bly. J. A. S. B. xxviii, p. 294.—Shwe Gyen, Burma.
1866. *beavani*, Pet. P. Z. S. p. 559.—Manbhoom.
1898. *famulus*, Bonh, J. B. N. H. S. xii, p. 99.—Nilgiris.

1912. *dunni*, Wrough. J. B. N. H. S. xxi, p. 339.—Ambala, Punjab.

1914. *cookii*, Ryl. J. B. N. H. S. xxii, p. 664.—Gokteik, Shan States.

1916. *pahari*, Thos. J. B. N. H. S. xxiv, p. 415.—Batasia, Sikkim.

Four of these Thomas recognises as distinct, *viz* :—*pahari, famulus, cookii* and *nitidulus* (differentiating a subspecies of *nitidulus*) from Mt. Popa. The rest he lumps together, as a group, under the name *booduga*, pending further study. These forms may be arranged in a key as follows :—

Key to the forms of LEGGADA.

A.—Supraorbital edges quite without any thickening; incisors generally bent backwarks (opisthodont).
  a. Size larger; braincase rounded, its breadth more than 10mm.; palatal foramina penetrating less far backward between the molars.
    a^1. Palatal foramina very short, not reaching at all between molars... 1. *pahari*, Thos.
    b^1. Palatal foramina longer, reaching just between the front of anterior molars.
      a^2. Colour very dark, coppery; underside scarcely lighter, washed with ochraceous ... 2. *famulus*, Bonh.
      b^2. Colour normal, brown; underside lighter, greyish white ... 3. *cookii*, Ryl.
  b. Size smaller, often very small; braincase narrow, less than 10mm. not specially rounded; palatal foramina penetrating far between molars ... ... 4. *booduga*, Gray.
B.—Supraorbital edges thickened in old age; incisors about upright (orthodont).
  a. Size smaller; tail shorter (64—73mm); colour rather darker, median area of back distinctly darker... 5. *n. nitidulus*, Bly.
  b. Size larger; tail longer (75—80mm); colour rather paler, dark median dorsal mark absent ... ... 6. *n. popæus*, Thos.

DISTRIBUTION :—

1. *L. pahari*, Thomas.	*Type locality* :—Batasia, Sikkim (B. N. H. S.—Crump). *Other localities* :—Chuntang, Sikkim (M. S. I.). *Type* :—B. M. No. 15.9.1.199.
2. *L. famulus*, Bonhote.	*Type locality* :—Coonoor, Nilgiris. *Other localities* :—None. *Type* :—B. M. No. 97.11.12.1.
3. *L. cookii*, Lyley.	*Type locality* :—Gokteik, N. Shan States. *Other localities* :—Chin Hills; Chindwind; Shan States (M.S.I.). *Type* :—B. M. No. 13.11.18.2.
4. *L. booduga*, Gray.	*Type locality* :—"Dharwar." (Elliot). *Other localities* :—Ahmednagar; Dharwar (Elliot); Madras (Jerdon); Trichinopoli; Travancore; Ceylon; Orissa; Calcutta (B. M.); Kathiawar; Palanpur; Khandesh; Berars; Nimar; Central Provinces; Satara; Ratnagiri; Dharwar; Kanara; Bellary; Mysore; Coorg; Ceylon; Kumaon; Behar Bhutan Duars; Chin Hills; Chindwin; Mt. Popa; Pegu (M. S. I.). *Co-types* :—B. M. Nos. 37. *a. b.* & *d.* (Co-types of *lepidus*, Elliot, the same specimens; Co-types of *cervicolor*, Hodgson, B. M. Nos. 45.1.8.383. & 385; Lectotype :—B. M. No. 45. 1.8.383; Type of *strophiatus*, Hodgson, B. M. No. 45.1.8.384; Co-types of *terricolor*, Blyth, Ind. Mus. Calc. Nos. *a. f.* and *n—o*; Type of *darjilingensis*, Horsfield, B. M. No. 79.11. 21.412. Type of *fulvidiventris*, Blyth, Ind. Mus. Calc. No. 1; Type of *beavani*, Peters, not traced; Type of *dunni*, Wroughton, B. M. No. 9.4. 6.36; Type of *albidiventris*, Blyth, not traced; Type of *cunicularis*, Blyth, Ind. Mus. Calc. No. *a.—c.*; Type of *dunni*, Wroughton, B. M. No. 9.4.6. 361). *Lectotype* :—B. M. No. 37.*a*.

5. *L. nitidula nitidula*, Blyth.	*Type locality* :—Shwe Gyen, Burma. *Other localities* :—Pegu (M.S.I.). *Type* :—Not traced.
6. *L. nitidula popœa*, Thomas.	*Type locality* :—Mt. Popa (B. N. H. S.—Shortridge). *Other localities* :—Mt. Popa (M. S. I.). *Type* :—B. M. No. 14.7.19.200.

Gen. XIV.—Cœlomys.

The genus was established by Thomas (J. B. N. H. S., xxiii, p. 414, 1915) to accommodate a species discovered by the Survey in Ceylon.

In addition to the genotype, *mayori*, Thomas added later a second species, *bicolor* (J. B. N. H. S., xxiv, p. 49, 1915). These may be distinguished as follows :—

Key to the species of Cœlomys.

A.—Hairs of underside slate-coloured, with white tips; spines narrow (·2 mm.) and not stiff . ... 1. *mayori*, Thos.
B.—Hairs of underside pure white; spines coarser (·4 mm.) and stiff... ... 2. *bicolor*, Thos.

Distribution :—

1. *C. mayori*, Thomas.	*Type locality* :—Pattipola, 6,210 Ceylon. (B. N. H. S.—Mayor). *Other localities* :—Pattipola (M.S.I.) *Type* :—B. M. No. 14.12.1.7.
2. *C. bicolor*, Thomas.	*Type locality* :—Kottawa, 250′, Ceylon. (B. N. H. S.—Mayor). *Other localities* :—None. *Type* :—B. M. No. 14.12.1.8.

Gen. XV.—Vandeleuria.

No. 270. *oleracea*, Benn. In addition to this, the genotype, Miss Ryley gave the subspecific name *spadicea*, (J. B. N. H. S., xxii, p. 659, 1914) to the Kathiawar form and Thomas the subspecific names *modesta* (J. B. N. H. S., xxiii, p. 202, 1914) and *marica* (J. B. N. H. S., xxiv, p. 54, 1915) to forms from Kumaon and Orissa, and the latter also revived the names *nilagirica*, Jerdon, and *dumeticola*, Hodgson, and established the species *rubida* (J. B. N. H. S. xxiii, 1914) from Kumaon. These seven forms may be arranged in a key as follows :—

Key to the Species of VANDELEURIA.

A.—General colour bright, rich fulvous.
  a. Teeth larger, 3·5 mm.; bright tawny line on the flanks ... ... 1. *rubida*, Thos.
  b. Teeth smaller, 3·2 mm.; no bright tawny line on flanks ... ... 2. *dumeticola*, Hodgs.
B.—General colour other.
  a. Size larger, hindfoot about 20 mm. 3. *nilagirica*, Jerd.
  b. Size smaller, hindfoot about 18 mm.
    a^1. No dark face markings; feet white.
      a^2. Colour darker, fawn colour ... 4. *o. oleracea*, Benn.
      b^2. Colour paler, vinaceous, cinnamon ... ... 5. *o. spadicea*, Ryl.
    b^1. dark lines from snout to eyes; feet drab.
      a^2. General colour drab ... ... 6. *o. modesta*. Thos.
      b^2. General colour brown... ... 7. *o. marica*, Thos.

DISTRIBUTION :—

1. *V. rubida*, Thomas.	*Type locality* :—Bageswar, Kumaon. (B. N. H. S.—Crump). *Other localities* :—None. *Type* :—B. M. No. 14. 12. 1. 3.
2. *V. dumeticola*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities* :—Nepal (B. M.); Bhutan Duars; Chin Hills; Mt. Popa (M. S. I.). *Type* :—B. M. No. 43. 1. 12. 74.
3. *V. nilagirica*, Jerdon.	*Type locality* :—Ootacamund. (Jerdon). *Other localities* :—Kolaba; Nilgiri Hills (B. M.). Coorg (M. S. I.). *Type* :—Unknown.
4. *V. oleracea oleracea*, Bennett.	*Type locality* :—"Dukhun" (Sykes). *Other localities* :—Surat; Sehore; Central India; Berars; Nimar; Central Provinces; Ahmednagar; Dharwar; Bengal (M. S. I.). *Type* :—B. M. No. 55. 12. 26. 286. (Type of *wroughtoni*, Ryley, B. M. No. 98. 4. 2. 31).

5. *V. oleracea spadicea,* Ryley.	*Type locality* :—Palanpur. (B. N. H. S.—Crump). *Other localities* :—Palanpur (M.S.I.). *Type* :—B. M. No. 13. 8. 23. 4.
6. *V. oleracea modesta,* Thomas.	*Type locality* :—Ramnagar, Kumaon (B. N. H. S.—Crump). *Other localities* :—Kumaon (M.S.I.) *Type* :—B. M. No. 14. 12. 1. 2.
7. *V. oleracea marica,* Thomas.	*Type locality* :—Chaibassa, Orissa. (B. N. H. S.—Crump). *Other localities* :—Orissa (M. S. I.). *Type* :—B. M. No. 15. 4. 3. 108.

Gen. XVI.—Hæromys.

This genus was separated from Mus, by Thomas, to provide for certain Bornean forms.

No. 281. *chiropus*, Thos. The name *chiropus* is based on a single specimen taken by Fea. As the description given of it by Thomas seems to agree in many ways with the characters ascribed to Hæromys I have placed it tentatively in that genus.

Distribution :—

H. chiropus, Thomas.	*Type locality* :—Karennee (Fea). *Other localities* :—None. *Type* :—Mus. Civ. Genoa.

Gen. XVII.—Hadromys.

The genus was founded by Thomas (J. B. N. H. S. xx, p. 999, 1911) to accommodate a mouse, *humei*, from Manipur described by himself in 1886 (P. Z. S., p. 63).

No. 293. *humei*, Thos. The genotype and only species.

Distribution :—

H. humei, Thomas.	*Type locality* :—Moirang, Manipur. (Hume). *Other localities* :—(None). *Type* :—B. M. No. 85. 8. 1. 318.

Gen. XVIII.—Golunda.

Blanford lumps this genus with the African Pelomys, but their separation is now quite generally recognised.

No. 299. *ellioti*, Gray. Kelaart gave two names in Ceylon but I have been able to retain only one of them, *viz* :—*newera* (J. B. N. H. S., xxiv, p. 94, 1915).

Blanford gave the name *watsoni* to the form from northern India. Hodgson named a "*Mus myothrix*," which the mutilated skin, which constitutes the type, shows to have been a GOLUNDA (?) but pending the receipt of further specimens I can only rank it as *elliotti.* These three forms may be arranged in a key as follows:—

Key to the species of GOLUNDA.

A.—Colour darker, grizzled black and tawny.
  a. Grizzle coarse ... ... 1. *ellioti*, Gray.
  b. Grizzle very fine ... ... 2. *newera*, Kel.
B.—Colour paler, grizzled black and buff ... 3. *watsoni*, Blanf.

DISTRIBUTION :—

1. *G. ellioti*, Gray.

Type locality :—"Dharwar" (Elliot).

Other localities :—Bombay; Nepal (B. M.); Khandesh; Berars; Nimar; Central Provinces; Satara; Dharwar; Kanara; Coorg; Kumaon; Bengal; Bhutan Duars (M. S. I.).

Co-types :—B. M. Nos. 38. *a.* & *d.*; (Type of *myothrix*, Hodgson, B.M. No. 45. 1. 8. 375.; Type of *coffæa*, Kelaart, B. M. No. 52. 5. 9. 30).

Lectotype :—B. M. No. 38. *a.*

2. *G. newera*, Kelaart.

Type locality : Newera Eliya, Ceylon. (Kelaart).

Other localities :—Pattipola and Ambewela, Ceylon. (M. S. I.).

Type :—Not traced.

3. *G. watsoni*, Blanford.

Type locality :—Kirtar Range, Sind. (Watson).

Other localities :—Kohat; Dagshai, Umballa, Punjab (B. M.); Sind; Cutch; Palanpur; Kathiawar (M. S. I.).

Type :—B. M. No. 8. 3. 9. 23.

Gen. XIX.—CHIROPODOMYS.

No. 271. *gliroides*, Bly. Sclater in his "Catalogue of Mammalia in the Indian Museum, Calcutta" records the loss of the type of *gliroides*, and that consequently it is not possible to identify that species. I propose therefore to ignore that name and to use *peguensis*, Blyth.

DISTRIBUTION :—

C. peguensis, Blyth.	*Type locality* :—Schwe Gyen (Berdmore). *Other localities* :—Malay Peninsula ; S. W. Siam (B. M.) ; Tenasserim (M. S. I.). *Type* :—Ind. Mus. Calc. No. *a*.

Gen. XX.—APODEMUS.

No. 286. *arianus*, Blanf.
No. 284. *sublimis*, Blanf.

There is I believe no reliable record of the occurrence of *sublimis* within our limits, while *arianus* was given to a Persian species. I wrote a note on these animals in 1908 (J. B. N. H. S., xvii, p. 280) in which I recognised three forms, ranking them all as subspecies of *sylvaticus* L., of Europe. One of these having been found to bear the preoccupied name *griseus*, True, Miller has substituted the name *rusiges*. These names may be arranged in a key as follows :—

Key to the subspecies (Indian) of Apodemus sylvaticus.

A.—Tail at least as long as the head and body.
  a. Larger, hind-foot 23 mm.; colour darker, ochraceous brown ... 1. *s. rusiges*, Mill.
  b. Smaller, hind-foot 21 mm. ; colour paler, drab ... ... 2. *s. wardi*, Wr.
B.—Tail shorter than head and body ; hind-foot 21 mm. ... ... 3. *s. pentax*, Wr.

DISTRIBUTION :—

1. *A. s. rusiges*, Miller.	*Type locality* :—Central Kashmir. (Abbott). *Other localities* :—Kashmir (Ward) (B. M.). *Co-types* .—U. S. Nat. Mus. Nos. $\frac{20139}{35502}$, $\frac{20144}{35507}$ and $\frac{20151}{35514}$.
2. *A. s. wardi*, Wroughton.	*Type locality* :—Saspul, 9,000′—11,500′, Ladak. (Ward—Crump). *Other localities* :—Ladak ; Skardo (Whitehead) (B. M.). *Type* :—B. M. No. 7. 12. 16. 2.
3. *A. s. pentax*, Wroughton.	*Type locality* :—Thandiani, Punjab. (Maj. Magrath). *Other localities* :—Hazara ; Murree (Dunn). (B. M.). *Type* :—B. M. No. 7. 8. 1. 4

Gen. XXI.—MICROMYS.

No. 292. *erythrotis*, Bl. The only species found within our limits.

DISTRIBUTION :—

M. erythrotis, Blyth.

Type locality :—Cherrapunji, Assam. (F. Skipwith).

Other localities :—Cherrapunji (B. M.)

Type :—Ind. Mus. Calc. No. *a*.

Gen. XXII.—ACOMYS.

No. 298. *dimidiatus*, Rüpp. The name used by Blanford is that of a species from Palestine. Thomas has examined the single specimen, taken in 1876, by H. E. Watson, and has described it under the name of *flavidus*, (J. B. N. H. S., xxv, p. 205, 1917).

DISTRIBUTION :—

A. flavidus, Thomas.

Type locality :—Laki Hills, Sehwan, Sind. (Watson).

Other localities :—None.

Type :—B. M. No. 91. 11. 1. 11.

Gen. XXIII.—HAPALOMYS.

No. 269. *longicaudatus*, Bl. The only species of the genus.

DISTRIBUTION :—

H. longicaudatus, Blyth.

Type locality :—Sitang Valley, Tenasserim. (Berdmore).

Other localities :—Meta, Tavoy; S. W. Siam (B. M.); Tenasserim (M.S.I.).

Co-types :—Ind. Mus. Calc. Nos. *a* and *b*.

(*To be continued*).

THE FLORA OF THE INDIAN DESERT.

(JODHPUR AND JAISALMER).

BY

E. Blatter, S.J., and Prof. F. Hallberg.

Part IV.

(*Continued from page* 818 *of Vol. XXVI.*)

Chenopodiaceæ.

Chenopodium L.

Chenopodium album, L. Sp. Pl. (1753) 219.
Vern. N.: Goela, Chill (Macadam).
Loc.: Very common about fields and gardens (Macadam).
Distrib.: Cosmopolitan.
Uses: The boiled leaves are eaten as a vegetable.

Atriplex L.

Atriplex sp.
Loc.: Jodhpur: Towards mouth of Luni (King).

Suæda Forsk.

Suæda fruticosa, Forsk. Fl. Ægypt. Arab. (1775) 70.
Vern. N.: Lunki (Macadam).
Loc.: Jodhpur: Abundant in the salt districts of Pach Badra; found also at Palli (Macadam).
Distrib.: Africa, India, America.
Uses: Eaten by camels.

Haloxylon Bunge.

Haloxylon recurvum, Bunge ex Boiss. Fl. Or. IV (1879) 949.
Vern. N.: Khar.
Loc.: Jodhpur: Kotda near Seu (No. 9092!), Jaisalmer: Vinjorai on rocks (Nos. 9091!, 5974!).
Distrib.: India, Afghanistan, Yunnan.
Fl. in October and November.
Uses: The ashes are given in water against internal ulcers. Used by dhobies instead of soap.
Haloxylon salicornicum, Bunge ex Boiss. Fl. Or. IV (1879) 949.
Vern. N.: Lana.
Loc.: Jodhpur: Common in the salt districts of Pach Badra (Macadam). Jaisalmer: Sodakoer river bed (No. 9093!).
Distrib.: India, Baluchistan, Afghanistan.
Uses: Eaten by camels.
Haloxylon multiflorum, Bunge in Boiss. Fl. Or. IX, 949.
Loc.: On Sind frontier (King).
Distrib.: N. W. India, Afghanistan, Rajputana.

Salsola L.

Salsola fœtida, Del. Fl. Ægypt. Illustr. (1812) 310.
Vern. N.: Lani (Macadam).
Loc.: Jodhpur: Barmer, rocks (No. 9095!). Jaisalmer: Bap, shore of tank (No. 9096!), Sodakoer (No. 9094!).
Distrib.: India, Baluchistan, Persia, Arabia, N. Africa.
Fr. in October and November.

POLYGONACEÆ.

Calligonum L.

Calligonum polygonoides, L. Sp. Pl. (1753) 530.
Vern. N.: Phog.
Loc.: Jodhpur: Bhikamkor (Nos. 9064!, 9062!, 9056!), common and gregarious in the salt districts of Pach Badra, near Bhadka (No. 9055!), Barmer rocks (No. 9057!), Phalodi (No. 9065!). Jaisalmer: near Loharki (Nos. 9061!, 9058!), near Loharki sand dunes (No. 9059!), Loharki (No. 9060!), Vinjorai (No. 9063!).
Distrib.: India, Persia, Armenia, Syria.
Fl. in October.
Fr. in October and November.
Uses: The wood is used in building huts, wells, etc.; the green branches are eaten by camels; the buds, called "lasson," are used by the poor as food in February and March. (Macadam).

Polygonum L.

Polygonum plebejum, R. Br. Prodr. (1810) 420, *var. sindica,* Hook. f. Fl. Brit. Ind. V, 29.
Loc.: Jodhpur: Kailana (No. 9080!).
Distrib.: Sind, Rajputana.
Fl. and fr. in October and November.

Polygonum plebejum var. indica, Hook. f. Fl. Brit. Ind. V, 28.
Loc.: Jodhpur: Jodhpur Fort (No. 9090!). Jaisalmer: between Phalodi and Bap (No. 9083!), N. of Jaisalmer (No. 9082!), Vinjorai (No. 9081!).
Fl. and fr. in October and November.

Fagopyrum Gærtn.

Fagopyrum esculentum, Mœnch Meth. 290.
Loc.: Jaisalmer: Amarsagar (No. 9084!). Introduced.

ARISTOLOCHIACEÆ.

Aristolochia L.

Aristolochia bracteata, Retz Obs. Bot. fasc. V (1789) 29.
Vern. N.: Hookah bel, Aoula sa (Macadam).
Loc.: Jodhpur: Barmer, sand (No. 9258!), near Badka (No. 9257!). Jaisalmer: Vinjorai, near tank (No. 9259!).
Distrib.: Trop. Africa, Arabia, India, Ceylon.
Uses: The seeds ground in water form a lotion softening the hair.

LAURACEÆ.

Cassytha L.

Cassytha filiformis, L. Sp. Pl. (1753) 35.
Loc.: Jodhpur: Mandor (Nos. 9255!, 9256!).
Distrib.: Tropics generally.

EUPHORBIACEÆ.

Euphorbia L.

Euphorbia neriifolia, L. Sp. Pl. (1753) 451.
Vern. N.: Thor.
Loc.: Jodhpur: Kailana (No. 9196 !), Barmer (9195 !). Jaisalmer: Jaisalmer (No. 9194 !). Abundant in rocky places. (Macadam).
Distrib.: India.
Fl. in February and March (Macadam).
Uses: The milky juice is used as a cure for coughs and is applied to the skin as a blister. The leaves, called "papri", are eaten (Macadam).

Euphorbia dracunculoides, Lamk. Encycl. Meth. II (1786) 428.
Vern. N.: Bamburi (Macadam).
Loc.: Jodhpur: Barmer, sand (No. 9197 !). Jaisalmer: Gagruap Sayar (Macadam).
Distrib.: Trop. Africa, Arabia, India.
Fl. early in December (Macadam), November.

Euphorbia elegans, Spreng. Syst. III (1826) 794.
Loc.: Jodhpur Fort (No. 2956 !).
Distrib.: India.
Fl. and fr. in October.

Euphorbia hypericifolia, L. Sp. Pl. (1753) 454.
Vern. N: Dudeli (Macadam).
Loc.: Jodhpur: Balsamand (No. 2958 !). Jaisalmer: Amarsagar (Nos. 2957 !, 2960 !, 2959 !), Bada Bag (Nos. 2963 !, 2961 !, 2962 !).
Distrib.: Almost throughout the Tropics.
Fl. and fr. in October and November.

Euphorbia hirta, L. Sp. Pl. (1753) 454.
Loc.: Jodhpur: Balsamand (No. 9198). Jaisalmer: Amarsagar (Nos. 9199 !, 9200 !).
Distrib.: Most tropical and subtropical countries.
Fl. and fr. in October and November.

Euphorbia thymifolia, L. Sp. Pl. (1753) 454.
Loc.: Jodhpur: Jodhpur Fort (No. 9201 !), Phalodi (No. 9202 !). Jaisalmer: Jaisalmer (No. 9203 !), near Loharki (No. 9204 !).
Distrib.: All hot countries except Australia.
Fl. and fr. in October and November.

Euphorbia granulata, Forsk. Fl. Ægypt. Arab. (1775) 94.
Vern. N.: Dudeli.
Loc.: Jodhpur: Mandor (No. 2972!), Bhikamkor (Nos. 2973 !, 2976!), Barmer, gravel (No. 9206 !), Barmer, sand (No. 2964 !). Jaisalmer: Bap (Nos. 2975 !, 9207 !, 2969 !), near Bap (No. 2970 !), N. of Jaisalmer (No. 9205 !), Amarsagar (No. 2974 !), Jaisalmer (No. 2965 !), Jaisalmer, sand (No. 2967 !), Jaisalmer, rocky plateau (No. 2977 !), Vinjorai, sand (No. 2971 !), Vinjorai, rocks (Nos. 2968 !, 9208 !), near Devikot (No. 2966 !). Often covering large patches of sandy ground; frequently associated with *Corchorus antichorus* in the desert tracts between Balotra and Jaisalmer (Macadam).
Distrib.: India, Afghanistan, Arabia, Egypt, Canary Isles.
Fl. and fr. in October and November.

Euphorbia granulata var. glabra var. nov.—Folia glabra in facie ventrali.
Loc.: Jodhpur Fort.

Euphorbia microphylla, Heyne in Roth Nov. Pl. Sp. (1821) 229.
Loc.: Jodhpur: Bhikamkor (No. 9211 !), Balarwa (No. 9212 !), Barmer, sand (No. 9213 !), Phalodi (No. 9214 !). Jaisalmer: Loharki (No. 9215 !), Jaisalmer (Nos. 9216 !, 9217 !).
Distrib.: Indo-Malaya.
Fl. and fr. in October and November.

Euphorbia clarkeana, Hook. f. Fl. Brit. Ind. V (1887) 253.
Loc.: Jodhpur: Phalodi (No. 9218 !). Jaisalmer: between Phalodi and Bap (No. 9219 !), Amarsagar (No. 9220 !), Vinjorai, dunes (No. 9221!).
Distrib.: India.
Fl. and fr. in October and November.

Euphorbia jodhpurensis, spec. nov.—Generatim sicut E. clarkeana, his exceptis: Caules pauci filiformes erecti colore stramineo. Folia 15 mm. attingentia, generatim toto margine spinuloso-serrulata, apice obtusa vel subacuta stipulis laceratis. Cocci aliquantulum carinati. Semina 4-angulata, apice attenuata obtusa, distincte transversim rugosa, roseo-brunnea, delicatulo-foveolata.
Loc.: Jodhpur (No. 9228 !).

Phyllanthus L.

Phyllanthus maderaspatensis, L. Sp. Pl. (1753) 982.
Loc.: Jodhpur: Balarwa (No. 9229 !), Osian (No. 9230 !), Kailana (No. 9231 !), Mandor (No. 9231a !), 25 miles S. E. of Luni (No. 9232 !), near Kotda (No. 9233 !). Jaisalmer: between Phalodi and Bap, fields (No. 9234 !).
Distrib.: Tropics of the Old World.
Fl. and fr. in October.

Phyllanthus nirurii, L. Sp. Pl. (1753) 981.
Vern. N.: Gugerati bawal (Macadam).
Loc.: Jodhpur: Jodhpur (Nos. 9235 !, 9241 !, 9251 !), Balsamand (No. 9240 !); Osian (No. 9237 !), Bhikamkor (Nos. 9246 !, 9242 !), Phalodi (No. 9239 !), near Bhadka, sand (Nos. 9249 !, 9238 !) Barmer, sand (No. 9245 !). Jaisalmer: between Phalodi and Bap, fields (No. 9244 !). Amarsagar (No. 9243 !), Bada Bag (No. 9250 !), Devikot, gravel (Nos. 9248 !, 9247 !), Vinjorai, sand (No. 9236 !).
Distrib.: Tropics generally, except Australia.
Fl. and fr. in October and November.
Uses: The root pounded and mixed with *Commiphora mukul* is given to camels suffering from indigestion.

Ricinus L.

Ricinus communis, L. Sp. Pl. 1007.
Loc.: Jaisalmer: Bap (No. 9252 !).
Distrib.: Tropics generally, probably indigenous in Africa; cultivated throughout India.

URTICACEÆ.

Ficus L.

Ficus religiosa, L. Sp. Pl. (1753) 1059.
Vern. N.: Pipal.
Loc.: Jodhpur: Bhikamkor (No. 9001 !), Jaisalmer: Amarsagar (No. 9004 !).
Distrib.: Subhimalayan forests in Bengal and Central India.
Uses: The roots are used medicinally. The wood is of little value, but is used in sacrificial fires. In Godwar it has been observed that the Pipal is appealed to by the Bauris on their stones of witness to punish them if they break their vows. (Macadam).

Ficus bengalensis, L. Hort. Cliff. (1737) 471, No. 4.
Vern. N.: Bar, Baryat.
Loc.: Jodhpur: Bhikamkor (No. 9002 !).
Distrib.: Wild in the subhimalayan forests and on the lower slopes of the hill ranges of Southern India.

Ficus mysorensis, Heyne in Roth Nov. Sp. Pl. (1821) 390, *var. pubescens* King, Spec. Fic. 20.
Loc.: Jodhpur: Barmer (No. 9003 !), planted.
Distrib.: Konkan, Kanara.

Morus L.

Morus alba, L. Sp. Pl. (1753) 986.
Loc: Jaisalmer: Amarsagar (No. 9006 !).
Distrib.: Cultivated in Europe, Western and Central Asia, and in China.

Cannabis L.

Cannabis sativa, L. Sp. Pl. (1753) 1027.
Loc.: Jaisalmer: Amarsagar (No. 9005 !).
Distrib.: Wild in Central Asia, cultivated elsewhere.
Fr. in November.

GNETACEÆ

Ephedra L.

Ephedra foliata, Boiss. Fl. Orient. V (1881) 716.
Vern. N.: Lana (Macadam).
Loc.: Jaisalmer (King).
Distrib.: Punjab, Rajputana, Afghanistan to Syria.

HYDROCHARITACEÆ.

Vallisneria L.

Vallisneria spiralis, L. Sp. Pl. (1753) 1015.
Loc: Jaisalmer: between Phalodi and Bap (No. 9340 !).
Distrib.: Warm regions of the Old and New World.
Fl. in October.

LILIACEÆ.

Asparagus L.

Asparagus racemosus, Willd. Sp. Pl. II (1799) 152.
Vern. N.: Narkanta.
Loc.: Jodhpur: Kotda (No. 10355 !), Kailana (No. 10356 !) growing in Euphorbia bushes near Balsamand and elsewhere about Jodhpur. (Macadam).
Distrib.: Indo-Malaya.
Fl. in November, the flowers appearing before the leaves.

Dipcadi Medic.

Dipcadi erythræum, Webb. & Berth.
Loc.: Jaisalmer: near Bap (No. 10358 !), N. of Jaisalmer (No. 10359 !).
Distrib.: Rajputana, Sind, Arabia, Egypt.
Fr. in November.

Asphodelus L.

Asphodelus tenuifolius, Cav. in Ann. Cienc. Nat. III (1801) 46, t. 27, f. 2.
Loc.: Jodhpur: Balarwa (No. 10357 !). A weed of cultivation.
Distrib.: India to the Mediterranean.
Fl. and fr. in October.

Allium L.

Allium cepa, L. Sp Pl. (1753) 300.—The Onion. Cultivated in many places. The soil called pili, a sandy clay, is especially adapted for it.

Aloe Tourn.

Aloe sp.
Loc.: Jaisalmer: Bap (No. 9193!).
Fl. in October. Flowers orange.

COMMELINACEÆ.

Commelina L.

Commelina benghalensis: L. Sp. Pl. (No. 1753) 41.
Loc.: Jodhpur: Mandor (No. 9175!), Osian (No. 9174!), Balarwa (Nos. 9178!, 9179!). Jaisalmer: Amarsagar (No. 9176!), Bada Bag (No. 9177!).
Distrib.: Tropical Africa and Asia.
Fl. and fr. in October and November.

Commelina Forskalœi, Vahl. Enum. I (1806) 172.
Loc.: Jodhpur: Balarwa (Nos. 9180!, 9181!).
Distrib.: Trop. Africa, India.
Fl. and fr. in October.

Commelina albescens, Hassk. in Schweinf. Beitr. Fl. Æthiop. (1867) 210.
Loc.: Jodhpur: Kailana (Nos. 9182!, 9183!), Balsamand, rocks (Nos. 9184!, 9186!, 9185!), Mandor (Nos. 9187!, 9188!, 9189!), Osian (No. 9190!). Jaisalmer: Bada Bag (Nos. 9192!, 9191!).
Distrib.: Trop. Africa, Arabia, Baluchistan, Sind, Rajputana.
Fl. and fr. in October and November.

Cyanotis Don.

Cyanotis axillaris, Schultes f. Syst. VII (1830) 1154.
Loc.: Jaisalmer: Bap (No. 9173!).
Distrib.: India, Ceylon, E. Asia, Trop. Australia.
Fl. and fr. in October.

NAIADACEÆ.

Potamogeton L.

Potamogeton pectinatus, L. Sp. Pl. (1753) 127.
Loc.: Jodhpur (No. 9331!). Jaisalmer: between Phalodi and Bap (No. 9332!), Bap (No. 9333!).
Distrib.: India, Ceylon, Western and Eastern Tibet.
Fruits in October.

Potamogeton crispus, L. Sp. Pl. (1753) 126.
Loc.: Jodhpur: Kailana (Nos. 9334!, 9335!).
Distrib.: N. and S. temperate, subtropical and tropical regions.
Fruits in October.

Potamogeton natans, L. Sp. Pl. (1753) 126.
Loc.: W. Rajputana (King).
Distrib.: Widely diffused, especially in temperate climates.

Naias L.

Naias graminea, Del. Fl. Egypt (1812) 282, t. 50, f. 3.
Loc.: Jodhpur State (No. 9338!), Jaisalmer: Bap (No. 9339!).
Distrib.: Old World.
Fl. and fr. in October.

Naias australis, Bory ex Chamisso in Linnæa IV (1829) 501.
Loc.: Jodhpur: Kailana (No. 9337 !).
Distrib.: Mauritius, Madagascar. Not been noted from India before.
Fr. in October.

Naias Welwitschii, Rendle in Cat. Afr. Pl. Welwitsch. II (1899) 95.
Loc.: Jaisalmer: Bap (No. 9336 !).
Distrib.: Trop. Africa. Not been observed in India before.
Fl. and fr. in October.

CYPERACEÆ.*

Cyperus L.

Cyperus pumilus, L. Sp. Pl. (1762) 69.
Loc.: Jodhpur: Kailana (No. 2877 !), Mandor (Nos. 2485 !, 2480 !). Jaisalmer: N. of Jaisalmer (No. 2906 !), Bada Bag (No. 2437 !), Vinjorai (Nos. 1962 !, 1960 !), Devikot, wet ground (No. 1957 !).
Distrib.: Tropics of the Old World.
Fr. in October and November.

Cyperus pygmæus, Rottb. Descr. et Ic. (1773) 20, t. 14, f. 5.
Loc.: Jodhpur: Kailana tank (No. 2879 !). Jaisalmer: N. of Jaisalmer (No. 2924).
Distrib.: Trop. and warm countries of the Old World.
Fr. in October and November.

Cyperus difformis, L. Cent. Pl. pt. 2 (1755), in Amœn. Acad. IV (1788) 302
Loc.: Jodhpur: Balsamand (No. 2947 !), Mandor (No. 2488 !).
Distrib.: Warm regions of the Old World.
Fr. in October.

Cyperus niveus, Retz. Obs. fasc. 5 (1789) 12.
Loc.: Jaisalmer: near Loharki (No. 2454 !).
Distrib.: India, Afghanistan, China.
Fr. in November.

Cyperus arenarius, Retz. Obs. fasc. 4 (1786) 9.
Loc.: Jodhpur: Mandor (No. 2487 !), Bhikamkor (No. 2865 !), Osian (No. 2922 !), Phalodi, sand dune (Nos. 2857 ! 2911 !). Jaisalmer: Shihad (No. 2927 !).
Distrib.: India, Ceylon, Persia, Arabia.
Fr. in October and November.

Cyperus conglomeratus, Rottb. Descr. et Ic. (1773) 21, t. 15, f. 7.
Loc.: Jodhpur: Jodhpur (No. 2943 !), Mandor (Nos. 2486 ! 2465 !), Balarwa (Nos. 2917 !, 2914 !), Bhikamkor, sand dune (Nos. 2887 !, 2894 !). Jaisalmer: between Phalodi and Bap (Nos. 2451 !, 2452 !), near Bap (No. 2938 !), Loharki (No. 2458 !), Jaisalmer (Nos. 2499 !, 1935 !), Vinjorai, sand dunes (Nos. 2913 !, 2912 !, 2497 !, 2498 !, 2493 !).
Distrib.: India, Ceylon, Mediterranean, Trop. Africa.
Fr. in October and November.

Cyperus compressus, L. Sp. Pl. (1753) 46.
Loc.: Jodhpur: Balarwa (No. 2921 !).
Distrib.: Tropics generally.
Fr. in October.

Cyperus aristatus, Rottb. Descr. et Ic. (1773) 23, t. 6, f. 1.
Loc.: Jodhpur: Kailana (Nos. 2945 !, 2941 !, 2900 !), Mandor (Nos. 2470 !, 2479 !). Jaisalmer: Bap (No. 1953 !), Jaisalmer, wet ground (No. 2927 !), Vinjorai (Nos. 2495 !, 1934 !, 1963 !).
Distrib.: More or less throughout the Tropics.
Fr. in October and November.

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*We have to thank Mr. L. J. Sedgwick, I.C.S., for kindly naming the Cyperaceæ.

Cyperus iria, L. Sp. Pl. (1753) 45.
Vern. N.: Moth.
Loc.: Jodhpur: Kailana (Nos. 2868 !, 2898 !, 2885 !), Mandor (No. 2461 !), near Badka (No. 2875 !), Badka, wet ground (No. 2856 !).
Distrib.: Mediterranean, Indo-China, Australia.
Fr. in October and November.

Cyperus eleusinoides, Kunth Enum. II (1837) 39.
Loc.: Jodhpur: Balsamand (No. 2933 !).
Distrib.: Trop. Africa, Indo-Malaya, Queensland.
Fr. in October.

Cyperus bulbosus, Vahl Enum. II (1806) 342.
Loc.: Jodhpur: Mandor (Nos. 2462 !, 2473 !), Jaisalmer: Amarsagar (Nos. 2935 !, 2910 !), Vinjorai, tank (No. 1664 !).
Distrib.: Trop. Africa, Baluchistan, India, Ceylon, Australia.
Fr. in October and November.

Cyperus rotundus, L. Sp. Pl. (1753) 45.
Loc.: Jodhpur: Kailana (Nos. 2884 !, 2876 !), Jodhpur (Nos. 2859 !, 2866 !), Mandor (Nos. 2475 !, 2478 !), Balarwa (No. 2918 !), Phalodi (No. 2864 !), Seu, wet ground (No. 2477 !), Kotda near Seu, wet ground (No. 2888 !), near Badka (No. 2873 !), Barmer, wet sand (No. 2861 !). Jaisalmer: between Phalodi and Bap (Nos. 1953 !, 2453 !, 2474 !), Sodakoer (No. 2925 !), Amarsagar (Nos. 2867 !, 2860 !), Jaisalmer (No. 1940 !), N. of Jaisalmer (No. 2907 !), Vinjorai, tank (Nos. 1961 !, 1967 !, 1936 !).
Distrib.: Most hot countries.
Fr. in October and November.

Cyperus tuberosus, Rottb. Descr. et Ic. (1773) 28, t. 7, f. 1.
Loc.: Jaisalmer: between Phalodi and Bap, cultivated fields (Nos. 2436 !, 2459 !).
Distrib.: Mauritius, India, Ceylon, Australia.
Fr. in October.

Kyllingia Rottb.

Kyllingia triceps, Rottb. Descr. et Ic. (1773) 14, t. 4, f. 6.
Loc.: Jodhpur: Mandor (Nos. 2466 !, 2484 !, 2472 !, 2464 !, 2481 !), Kailana (No. 2871 !).
Distrib.: India, Ceylon, China, Australia, Africa.
Fr. in October.

Fimbristylis Vahl.

Fimbristylis dichotoma, Vahl. Enum. II (1806) 287.
Loc.: Jodhpur: Kailana (No. 2883 !). Jaisalmer: N. of Jaisalmer (No. 2905 !).
Distrib.: Warm regions of the Old World.
Fr. in October and November.

Fimbristylis ferruginea, Vahl. Enum. II (1806) 291.
Loc.: Jodhpur: Kailana (No. 2899 !). Jaisalmer; Bada Bag (No. 1987 !).
Distrib.: Indo-Malaya, Australia, Polynesia.
Fr. in October and November.

Fimbristylis quinquangularis, Kunth. Enum. II (1806) 229.
Loc.: Jaisalmer: Bada Bag (No. 2955 !).
Distrib.: Indo-Malaya, China, Australia.
Fr. in November.

Fimbristylis tenera, Roem. and Schult. Syst. II, Mant. 57.
Loc.: Jodhpur: Kailana (No. 2886!), Balsamand (No. 2949!), Mandor (No. 2471!), Seu, wet ground (No. 2467!). Jaisalmer: between Phalodi and Bap (No. 2455!), Jaisalmer, wet ground (No. 2931!), Vinjorai (Nos. 2496!, 1966!), near Devikot (Nos. 1954!, 1955!).
Distrib.: Trop. Africa, India.
Fr. in October and November.

Fimbristylis tenera var. oxylepis, C. B. Clarke in Hook. Fl. Brit. Ind. VI, 642.
Loc.: Jodhpur: Kailana (No. 2880!), Badka (No. 2946!), Kotda near Seu (No. 2476!). Jaisalmer: Vinjorai, wet ground (No. 1938!).
Distrib.: India.
Fr. in October and November.

Eleocharis R. Br.

Eleocharis atropurpurea, Kunth Enum. II (1837) 151.
Loc.: Jodhpur: Mandor (Nos. 2482!, 2463!), Seu, wet ground (No. 2468!). Jaisalmer: between Phalodi and Bap (No 2457!), Bap (Nos. 1949!, 1952!).
Distrib.: Tropics generally.
Fr. in October and November.

Scirpus L.

Scirpus supinus, L. Sp. Pl. (1753) 49.
Loc.: Jaisalmer: Bap (No. 1950!).
Distrib.: Old World generally and America.
Fr. in October.

Scirpus quinquefarius, Ham. in Wall. Cat. (1828) 3465.
Vern. N.: Moth.
Loc.: Jodhpur: Kailana tank (No. 2870!), Mandor (Nos. 2483!, 2469!), between Phalodi and Bap (Nos. 2460!, 2456!, 2435!), near Badka (No. 2874!). Jaisalmer: Jaisalmer (No. 1939!), N. of Jaisalmer (No. 2904!), Bada Bag (Nos. 1979!, 1983!), Amarsagar (No. 1959!), near Devikot (No. 1956!), Devikot (No. 2863!), Vinjorai, wet ground (No. 1965!, 1937!).
Distrib.: India, Afghanistan, Baluchistan, Africa.
Fr. in October and November.

Scirpus maritimus, L. Sp. Pl. (1753) 51.
Loc.: Jaisalmer: Amarsagar (No. 2934!), Bada Bag (No. 1980!), Vinjorai (Nos. 1933!, 2494!).
Distrib.: Cosmopolitan.
Fr. in November.

Scirpus grossus, L. f. Suppl. (1781) 104.
Loc.: W. Rajputana, margins of tanks (King).
Distrib.: Indo-Malaya, Philippines.

Scirpus litoralis, Schrad. Fl. Germ. I (1806) 142, t. 5, f. 7.
Loc.: Jaisalmer: N. of Jaisalmer (No. 2903!).
Distrib.: Central Asia, India, Ceylon, Persia, Mediterranean, Africa.
Fr. in November.

Stenophyllus Rafin.

Stenophyllus barbata, T. Cooke Fl. Bomb. Pres. II, 887.
Loc.: Jodhpur: Balarwa (Nos. 2919!, 2920!). Jaisalmer: Bap (Nos. 1951!, 1948!).
Distrib.: India, Ceylon.
Fr. in. October and November.

GRAMINEÆ. *

Digitaria Rich.

Digitaria sanguinalis, Scop. Fl. Carn. ed. 2, I (1772) 52.
Loc.: Jodhpur: Balarwa (No. 4910 a !), Osian (No. 4143!). Jaisalmer: Between Phalodi and Bap (No. 4885 !), Sodakoer, near tank (No. 4097 !), Amarsagar (Nos. 4974 !, 4180 !, 4179 !).
Distrib.: All warm countries.
Fruits in October and November.

Digitaria sanguinalis var. ciliaris, Prain Beng. Pl. 1181.
Loc.: Jodhpur: Bhikamkor (No. 4666 a !), Balarwa (No. 4903 !), Mandor (No. 9750 !).
Jaisalmer: Amarsagar (Nos. 4883 !, 4878 !), Vinjorai dunes (No. 4797 !).
Distrib.: Most warm countries.
Fruits in October and November.

Digitaria pennata, Cooke Fl. Bomb. Pres. II. 941.
Loc.: Jodhpur: Kailana (Nos. 4981 a !, 4980 !, 4618 !, 4629 !), Barmer, rocks, in Euphorbia bush (No. 4881 !).
Distrib.: Gujarat, Rajputana, Sind, Baluchistan, Abyssinia.
Fruits in October and November.

Panicum L.

Panicum fluitans, Retz Obs. fasc. 5 (1789) 18.
Loc.: Jodhpur: Kailana, tank (No. 4677 !).
Distrib.: From tropical Africa to India, trop. America.
Fruits in October.

Panicum colonum, L. Syst. ed. 10 (1759) 870.
Loc.: Jodhpur: Jodhpur (No. 4648 !). Jaisalmer: Sodakoer, tank (Nos. 4101 !, 4096 !).
Distrib.: Most warm countries.
Fruits in October and November.

Panicum ramosum, L. Mant. (1767) 29.
Loc.: Jodhpur: Balarwa (Nos. 4900 ! 4913 !), Jaisalmer: Jaisalmer (No. 4830 !), Vinjorai, sandy plain (No. 3993 !, 3995 !), Vinjorai, on rocks (No. 4764 !), neighbourhood of Jaisalmer (No. 4120 !).
Distrib.: India, Ceylon, Afghanistan.
Fruits in October and November.

Panicum turgidum, Forsk. Fl. Aegypt. Arab. (1775) 18.
Vern. N.: Munt, Muruta gas.
Loc. Jodhpur: Kailana (Nos. 4627 !, 4630 !), Osian (Nos. 4145 ! 4138 !, 4134 !, 3997 !), Bhikamkor (Nos. 4661a !, 4659 !, 4665a !), Phalodi (No. 4937 !), Barmer, sand (No. 4199 !). Jaisalmer: Neighbourhood of Bap (No. 4044 !), Sodakoer (No. 4087 !), Loharki (Nos. 4845 !, 4841 !, 4696 !), Amarsagar (No. 4865 !), Vinjorai (No. 4799a !), Vinjorai, sand dunes (No. 4927 !)
Distrib.: Gujarat, Rajputana, Sind, Baluchistan, Egypt, Arabia, Trop. Africa.
Fruits in October and November.

Panicum trypheron, Schult. Mant. II (1824) 244.
Loc.: Jaisalmer: Amarsagar (Nos. 4956 !, 4961 !).
Distrib.: Trop. Africa, Indo-Malaya, China.

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* We have to thank Mr. L. J. Sedgwick and Mr. C. McCann for kindly naming the grasses.

Panicum antidotale, Retz Obs. fasc. 4 (1786) 17.
Vern. N. : Gramna.
Loc. : Jodhpur : Mandor (No. 4005 !), Osian (Nos. 4148 !, 4140 !, 3998 !), Barmer, sand (Nos. 4990 !, 4875 !). Jaisalmer : Near Bap (Nos. 4036 !, 4042 !), Loharki (No. 4169 !), near Loharki (No. 4071 !), Lohavat (No. 8762 !), Amarsagar (Nos. 4690 !), Jaisalmer, sand (No. 4826), Devikot (No. 4217 !, 4204 !, 4213 !), Vinjorai, dunes (Nos. 4798 !, 4911 !).
Distrib. : Trop. Africa, Afghanistan India, Ceylon, Australia.
Fruits in October and November.

Panicum crus-galli, L. Sp. Pl. 56.
Vern. N. : Siwan.
Loc. : W. Rajputana (Erskine).
Distrib. : All warm countries.

Panicum psilopedium, Trin. Gram. Panic. 217.
Vern. N. : Kuri.
Habitat : W. Rajputana (Erskine).
Distrib. : Hotter parts of India, Burma, Malacca, Ceylon.

Urochloa Beauv.

Urochloa panicoides, Beauv. Agrost. 52, t. 11, f. 1.
Loc. : Jodhpur : Osian (Nos. 4000 !, 4754 !).
Distrib. : Tropics generally.
Fruits in October.

Setaria Beauv.

Setaria verticillata, Beauv. Agrost. (1812) 51.
Loc. : Jaisalmer : Amarsagar (Nos. 4868 !, 4886 !), Bada Bag (Nos. 4699 !, 4804 a !).
Distrib. : Temperate and tropical regions.
Fruits in November.

Pennisetum Pers.

Pennisetum typhoideum, Rich. in Pers. Syn. I (1805) 72.
Vern. N. : Bajra.
Loc. : Jodhpur : Jodhpur (No. 4684 !), Mandor (No. 4777 !), Osian (No. 4732 !), Balarwa (Nos. 4899 ! 4914 !, 4917a !, 4901 !), Bhikamkor (No. 3706 !). Jaisalmer : Between Phalodi and Bap (No. 4887 !).
Distrib. : Probably a native of Africa, widely cultivated in India.
Uses : Bajra is the staple food of the majority of the people, and is more extensively grown than any other crop, thriving best in sandy soil. It is sown with the first fall of sufficient rain, takes from 70-90 days to ripen, and the average yield per acre is $1\frac{3}{4}$ cwt. The stalks, called kharia, are saltish and consequently sparingly used as fodder, but are suitable for thatching huts. The crop is sometimes grown alone, but more commonly mixed with moth and mung. (Erskine).

Pennisetum cenchroides, Rich. in Pers. Syn. I (1805) 72.
Vern. N. : Dhaman.
Loc. : Jodhpur : Jodhpur Fort (No. 4172 !), Mandor (Nos. 4002 !, 4015a !, 4776 !), Osian (Nos. 3999 !, 3995a !, 4133 !), Bhikamkor (No. 4603 !), Palodi (Nos. 4936 !, 4942, 4153 !, 4161 !), Barmer, sand (Nos. 4984a !, 4672 !), Barmer, rocks (No. 4674 !), Kotda near Seu (Nos. 8766 !, 4651 !). Jaisalmer : Between Phalodi and Bap, lake (No. 4893 !); Shihad, gravel (Nos. 4059 !, 4057a !), Sodakoer, riverbed (Nos. 4091 !, 4084 !, 4064 !), Loharki (No. 4694 !), near Loharki (No. 4853 !), Amarsagar (Nos. 4960 !, 4638 !, 4867 !), Vinjorai (No. 4932 !), Vingorai dunes (Nos. 4928 !, 4790 !), Devicot (No. 4827 !).

Distrib. : Trop. Africa, Mediterranean, India.

Fl. and fr. in October and November.

Pennisetum cenchroides var. echinoides, Hook. f. in Hook. f. Fl. Brit. Ind. VII, 88.

Loc. : Jophpur : Balsamand (No. 3904 !), Bhikamkor (No. 4664a !).

Distrib. : Africa, Madeira, Arabia, India.

Pennisetum prieurii, Kunth Rev. Gram. II, 411, t. 119.

Loc.: Jodhpur: Balarwa (No. 4911 !), Bhikamkor (Nos. 4661 a !, 4610 !), Barmer (No. 4986 !), Kotda, sand (Nos. 4790 a !, 3667 !). Jaisalmer: Lohavat (No. 3986 !), Loharki (Nos. 4847 !, 4850 !, 4693 !), near Devikot (Nos. 4816 !, 4822 !).

Distrib. : Trop. Africa, Punjab, Sind.

Fruits in October and November.

Cenchrus L.

Cenchrus biflorus, Roxb. Fl. Ind. I (1832) 233.

Loc.: Jodhpur : Jodhpur (Nos. 3910 !, 4681 !, 4679 !, 4983 !), Kailana, tank (Nos. 4496 a !, 4488 !), Osian (No. 3996 !), Barmer (No. 4870 !). Jaisalmer: Loharki (No. 4840 !), near Loharki (No. 4854 !), near Devikot (No. 4823 !), Amarsagar (Nos. 4877 !, 4636 !, 4975 !).

Distrib. : Africa, Arabia, Baluchistan, India.

Fruits in October and November.

Cenchrus catharticus, Del. Cat. Hort. Monsp. (1838).

Vern. N. : Bharut.

Loc.: Jodhpur: Jodhpur (Nos. 3909a !, 4683 !), Kailana (No. 4612 !), Mandor (No. 4744 !), Phalodi (Nos. 4151 !, 4947 !), Barmer, sand (No. 4199 a !). Jaisalmer : Amarsagar (No. 4972 !), Vinjorai, dunes (No. 4920 !).

Distrib.: Trop. Africa, Arabia, India.

Note : Bharut is particularly abundant in years of scarcity when the poorer people subsist on it ; the seed of this grass is about the size of a pin's head and is enclosed in a prickly husk, which causes a great deal of discomfort to both man and beast, as it sticks to the clothes of the former and in the hair of the latter and is very difficult to remove. (Erskine).

Tragus Haller.

Tragus racemosus, Scop. Intro. Hist. Nat. 73.

Loc. : Jodhpur : Kailana (Nos. 4625 !, 3903 !). Jaisalmer : Jaisalmer (No. 4829 !), Amarsagar (No. 4182 !), N. of Jaisalmer (No. 4112 !), Jaisalmer, rocky plateau (No. 4125 !), Vinjorai (No. 4767 !), Vinjorai, rocks (No. 4773 !).

Distrib. : Warm regions generally.

Fruits in October and November.

Latipes Kunth.

Latipes senegalensis, Kunth Rev. Gram. I, 261, t. 42.

Loc. : Jodhpur : Jodhpur (No. 4647a !), Kailana (No. 4624 !), Bhikamkor (Nos. 4657 !, 4658 !), Kotda near Seu (No. 8768 !). Jaisalmer : Loharki (Nos. 4848 !, 4884 !), Vinjorai (4921 !), N. of Jaisalmer (No. 4114 !), near Devikot (No. 4820 !).

Distrib. : Senegal, Abyssinia, Arabia, Sind, Baluchistan.

Fruits in October and November.

Perotis Ait.

Perotis latifolia, Ait. Hort. Kew. I, 85.
Loc.: Jodhpur: Jodhpur (Nos. 3813!, 4497!), Balarwa (No. 4915!), Osian (No. 4144!), Bhikamkor (Nos. 4159!, 4156!, 4606!, 4656!).
Distrib.: Trop. Africa and Asia, Afghanistan.

Zea L.

Zea Mays, L. Sp. Pl. 971.
Vern. N.: Maize, Indian Corn.
Loc.: Jodhpur, cultivated in many places.
Uses: This is an irrigated crop, generally grown on lands attached to wells, and is most common in Bali and Desuri. The fields are ploughed two or three times before the seed is sown broadcast in July or August, but a little early maze is often grown as fodder for the cattle. The crop ripens in about two months, and the outturn is ordinarily put at 8½ cwt. per acre. The cobs (dunda and makkia) are picked off, stripped, dried in the sun and beaten with sticks to separate the grain and the ripe ones are often roasted and eaten (Erskine).

Saccharum L.

Saccharum spontaneum, L. Mant. II, 183.
Loc.: Jodhpur: Bhikamkor (No. 4154!).
Distrib.: S. Europe and warm regions of the Old World.
Fruits in October.

Saccharum officinale, L. Spec. Pl. 54.
Loc.: Jodhpur: Phalodi (No. 3989a!).
Distrib.: Cultivated in the hotter parts of India.
Fruits in October.

Ischaemum L.

Ischaemum laxum, Br. Prodr. 205.
Vern. N.: Seran.
Loc.: Jodhpur: Balsamand (No.8749!), Mandor (No. 4743!).
Distrib.: Westwards to the Cape Verd Islands, eastwards to Australia.
Fruits in October.

Apluda L.

Apluda aristata, L. Cent. II, 7.
Loc.: Jodhpur: Barmer (No. 4197!).
Distrib.: Indo-Malaya, Australia, Pacific Islands.

Elionurus Humb. and Bonpl.

Elionurus royleanus, Nees ex A. Rich. Tent. Fl. Abyss. II (1851) 471.
Loc.: Jodhpur: Kailana (No. 4985!), Balsamand (No. 4176!), Mandor (No. 4013!), Kotda, rocks (Nos. 4791b! 4867!, 3807!) Barmer, rocks (Nos. 4676!, 4861!). Jaisalmer: Loharki (No. 4839!), near Loharki (Nos. 4852!, 4837!, 4070a!, 4069!), Jaisalmer (No. 4785a!), Jaisalmer, rocks (No. 4783!), Jaisalmer, sand (No. 8740!), Amarsagar (Nos. 4190!, 4804!, 4866!, 4963!, 4963a!, 4969!), Jaisalmer, rocky plateau (No. 4124!), Vinjorai, rocks (No. 4762!), Vinjorai, sandy plain (No. 4220!).
Distrib.: Mediterranean, Abyssinia, Arabia, India.
Fruits in October and November.

Elionurus hirsutus, Munro ex Benth. in Journ. Linn. Soc. XIX (1881) 68.
Vern.: N.: Sheven gas.
Loc.: Phalodi (Nos. 4171!, 4950!, 4948!, 4941!). Jaisalmer: Near Bap (No. 4043!), Sodakoer (No. 4095!), Sodakoer, sandy plain (No. 4093!), Jaisalmer, rocky plateau (No. 4128!). Vinjorai, sand (No. 4763!), Vijorai, dunes (No. 4791!), Vinjorai (No. 4922!).
Distrib.: N. Africa to India.
Fruits in October and November.

Andropogon L.

Andropogon foveolatus, Del. Fl. Egypt. 16a, t. 8, f. 2.
Loc.: Jodhpur: Kailana (No. 4981!), Balsamand (No. 4004!), Mandor (No. 4735 a!), Kotda (No. 4652!), Barmer (No. 4864!), Barmer, on rocks (Nos. 4859!, 4860!). Jaisalmer: Jaisalmer, rocky plateau (Nos. 4132!, 4123!, 4688!), Vinjorai, rocks (No. 4771!), Vinjorai, sand (No. 4757!).
Distrib.: From India to the Cape Verd Islands.
Fruits in October and November.

Andropogon pertusus, Willd. Sp. Pl. IV, 922.
Loc.: Jodhpur: Mandor (No. 4736!).
Distrib.: Mediterranean, Trop. Africa, Asia and Australia.
Fruits in October.

Andropogon sorghum, Brot. Fl. Lusit. I, 88.
Vern. N.: Jowar, Great Millet.
Loc.: Jodhpur: Osian (Nos. 4751!, 4146!), Bhikamkor (No. 4660!).
Distrib.: Cultivated throughout the warmer parts of Europe, Asia and Africa. Introduced into America, Australia, etc.
Fruits in October.
Note: Jowar requires a stiffer soil and a greater amount of rain than Bajra. It is sown between the middle of July and the end of August, and is harvested in October and November, the average yield being about 200 cwt. per acre. When the crop is ripe, the heads are cut off and the stalks (karab) are carefully stacked and subsequently given to cattle. If, owing to insufficient rain, the jowar is not thriving well, the stalks are often cut while green and stored for fodder, called chiptu, which fetches a better price than karab. (Erskine).

Andropogon squarrosus, L. f. Suppl. 433.
Loc.: Jaisalmer: Bada Bag (No. 4811!).
Distrib.: Trop. Africa, Indo-Malaya.
Flowers in November.

Andropogon annulatus, Forsk. Fl. Aegypt. Arab. 173.
Loc.: Jodhpur: Kailana (Nos. 8764!, 4631!), Bhikamkor (No. 3936!). Jaisalmer: Between Palodi and Bap (Nos. 4888!, 4039!, 4892!, 4035a!, 8743!), Sodakoer, tank (No. 4100!), Jaisalmer, rocky plateau (No. 4122!), Bada Bag (Nos. 4687!, 4807!, 4812!), Jaisalmer (No. 4879!): Amarsagar (Nos. 4976!, 4194!, 4639!, 4959!, 4965!), Devikot (Nos. 4206!, 4810!), Vinjorai (Nos. 4781a!, 4794!).
Distrib.: Trop. Africa, India, China, Australia, Pacific.
Fruits in October and November.

Andropogon iwarancusa, Jones in Asiat. Research. IV (1795) 109.
Loc.: Jodhpur: Kailana, tank (No. 8770!), Balsamand (No. 4008!), Mandor (Nos. 4756a!, 4780!, 4746!, 4776a!), Osian (Nos. 4750!, 4748!), Phalodi (Nos. 3989!, 4170!), Barmer, rocks (Nos. 4993!, 4863) Jaisalmer: near Bap (Nos. 4045!, 4740!), Sodakoer, river bed (Nos. 4065!, 4088!, 8763!), Vinjorai (No. 8769!).
Distrib.: N. Africa to India.
Fruits in October and November.

Cymbopogon Spreng.

Cymbopogon martini, Stapf in Kew Bull. (1906) 335-41.
Loc. : Jaisalmer : Jaisalmer, rocky plateau (No. 4121 !), N. of Jaisalme (No. 4110 !).
Distrib. : Trop. Africa to India.
Fruits in November.

Aristida L.

Aristida adscenscionis, L. Sp. Pl. (1753) 82.
Loc. : Jodhpur : Mandor (No. 4006a !), Bhikamkor (No. 4608 !), Bhikamkor, dunes, very common (No. 4667a !), Phalodi (No. 4015 !), Barmer (No. 4862 !), Barmer, rocks (No. 4991 !). Jaisalmer : N. of Jaisalmer (No. 4108 !), Amarsagar (No. 4186 !).
Distrib. : Most warm countries.
Fruits in October and November.

Aristida mutabilis, Trin. and Rupr. in Mem. Acad. Petersb. ser. VI, vol. VII (1849) 150 (excl. *var. æquilonga*).
Vern. N.: Lomp.
Loc. : Jodhpur : Jodhpur (Nos. 4496 !, 3914 a !), Kailana (No. 4489 !), Balarwa (No. 4909 !), Mandor (No. 3971 a !), Balsamand (No. 3984), Osian (No. 4731 !), Bhikamkor (Nos. 3777 !, 4662 !, 4668 !, 4997 !), Phalodi (Nos. 4946 !, 4943 !, 4945 ¡), Kotda (No. 4791 a !), Badka (No. 4047 !). Jaisalmer: Bap (Nos. 4026 !, 4024 !), Bap, gravel (No. 4883 !), near Bap (No. 4038 !), between Phalodi and Bap (No. 4884 !), Shihad (No. 4050 !), Sodakoer, river bed (No. 4089 !), near Loharki (Nos. 4838 !, 4698 !), Loharki (Nos. 4839 a !, 4846 !, 9344 !), Jaisalmer (No. 4977 !), Devikot (No. 4211 !), Vinjorai, dunes (Nos. 4929 !, 4926 !), Vinjorai, sandy plain (No. 3992 !), Vinjorai, sand (No. 4767a !), Vinjorai, rocks (No. 4768 !).
Distrib.: Trop. Africa, Arabia, India.
Fruits in October and November.

Aristida funiculata, Trin. and Rupr. in Mem. Acad. Petersb. ser. VI, vol. VII (1849) 159.
Loc.: Jodhpur: Kailana (Nos. 4619 !. 4935 !, 4616 !), Osian (Nos. 4149 !, 4137 !, 4735 !), Bhikamkor (No. 4667 !), Barmer (No. 4876a !), Barmer, rocks (No. 4837 !). Jaisalmer : Loharki (No. 4692 !), Amarsagar (Nos. 4955 !, 4308 !, 4882 !), Vinjorai (No. 3985 !), Vinjorai, dunes (No. 4934 !).
Distrib.: Trop. Africa, Arabia, Baluchistan, India.
Fruits in October and November.

Aristida hystricula, Edgew. in Journ. Linn. Soc. VI (1862) 208.
Loc.: Jodhpur: Kailana (Nos. 4984 !, 4635 !), Balarwa (No. 4904 !), Bhikamkor (No. 4669 !), near Badka (No. 4611 !). Jaisalmer: Bap (No. 4025 !), near Loharki (Nos. 4074 !, 4072 !, 4067 !), Sodakoer, gravel (No. 4099 !), Jaisalmer (No. 4189 !), Jaisalmer, rocky plateau (No. 4129 !), Devikot, sand (No. 4813 !) Vinjorai, sandy plain (No. 3991 !), Vinjorai, gravel (No. 4756 !).
Distrib.: Baluchistan, Sind, Punjab, Rajputana.
Fruits in October and November.

Aristida hirtigluma, Steud. Nom. ed. II, II, 231.
Loc.: Jodhpur: Kailana (No. 4614 !), Balarwa (No. 4902 !), Mandor (No. 4733a !), Bhikamkor (No. 4605 !), Osian (No. 4752!), Barmer,

rocks (No. 4200 !). Jaisalmer : Sodakoer, river bed (Nos. 4090 !, 4081 !, 4060 !), Sodakoer (No. 4062 !), near Loharki (Nos. 4857 !, 4068 !, 4075 !), Amarsagar (Nos. 4185 !, 8474 !), Vinjorai (No. 8756 !), Vinjorai, dunes (No. 4792 !).

Distrib.: Egypt and Abyssinia to India.

Sporobolus Br.

Sporobolus glaucifolius, Hochst. in Flora XXV(1842) I. Bieb. 123.

Loc. : Jodhpur : Balsamand (No. 4778a !). Jaisalmer : Sodakoer, tank (No. 4102 !), N. of Jaisalmer (No. 4109 !), Vinjorai (No. 4793a !), Vinjorai, wet ground (No. 4774 !).

Distrib. : Trop. Africa, Punjab, Sind, Rajputana.

Fruits in October and November.

Sporobolus orientalis, Kunth En. Pl. I, 211.

Loc. : Jodhpur : Jodhpur (Nos. 4495a !, 4493a !), Barmer, rocks (No. 4858 !). Jaisalmer : Bap, gravel (No. 4834 !), N. of Jaisalmer (No. 4107 !), near Devikot (No. 4821 !).

Distrib. : India, Ceylon.

Fruits in October and November.

Gracilea Koen.

Gracilea royleana, Hook. f. in Hook. f. Fl. Brit. Ind. VII (1897) 284.

Loc. : Jodhpur : Kailana (No. 4678 !), Bhikamkor (No. 3667a !), Barmer (No. 4987 !), Barmer, rocks (No. 4994 !). Jaisalmer : Shihad, gravel (No. 4853 !), Amarsagar (Nos. 4643 !, 4802 !), Jaisalmer (No. 4188), Vinjorai, sandy plain (No. 4218 !)

Vinjorai, rocks (No. 4766 !).

Distrib. : Nubia, Socotra, India.

Fruits in October and November.

Gracilea royleana var. plumosa, Hook. f. in Hook. f. Fl. Brit. Ind. VII, 284.

Loc. : Jodhpur : Barmer (No. 4197a !).

Distrib. : Abyssinia, Arabia, Punjab, Sind, Rajputana.

Fruits in November.

Cynodon Pers.

Cynodon dactylon, Pers. Syn. I, 85.

Vern. N. : Dubh, Dob.

Loc. : Jodhpur : Jodhpur Fort (No. 4173 !), Balarwa (Nos. 4906 !, 4908 !). Jaisalmer : Amarsagar (Nos. 4181 !, 4192 !).

Distrib. : All warm countries.

Fruits in October and November.

Chloris Sw.

Chloris pallida, Hook. f. in Hook. f. Fl. Brit. Ind. VII, 289.

Loc. : Jodhpur : Jodhpur (Nos. 4685 !, 8755 !). Jaisalmer : Between Phalodi and Bap (No. 4889 !), N. of Jaisalmer (No. 4115 !), Devikot (No. 4209 !), Vinjorai, near tank (No. 4755 !).

Distrib. : Bundelkand, Central India, Rajputana.

Fruits in October and November.

Chloris tenella, Roxb. Fl. Ind. I, 329.

Loc. : Jodhpur : Kailana (Nos. 4617!, 4621 !), Barmer, rocks (Nos. 4990a !, 4765 !, 4675 !). Jaisalmer : Bap (No. 9711 !).

Distrib. : Abyssinia, Arabia, India.

Fruits in October and November.

Chloris villosa, Pers Syn. I, 87.
Loc.: Jodhpur: Kailana (No. 4613 !), Mandor (No. 4777a !, 4778 !, 4011a !, 4007a !, 4732a), Osian (No. 4753 !), Bhikamkor (No. 4730 !). Jaisalmer: Vinjorai, rocks (No. 4770 !).
Distrib.: From the Canaries to India.
Fruits in October and November.

Chloris virgata, Sw. Fl. Ind. Occ. I, 203.
Vern. N.: Gharania gas.
Loc.: Jodhpur: Balsamand (No. 4174 !), Osian (No. 4136 !), Bhikamkor (No. 4663a !). Jaisalmer: N. of Jaisalmer (No. 4116 !), Jaisalmer (Nos. 4019 !, 4034 !, 4032 !).
Distrib.: Trop. and S. Africa, Mediterranean, India, China, Mongolia, America.
Fruits in October and November.

Chloris quinquesetica, Bhide in Journ. & Proc. As. Soc. Beng. (new ser.) VIII, (1912) 311.
Loc.: Jodhpur: Balsamand (No. 8748 !), Osian (No. 4141a !).
Distrib.: Western India, Rajputana.
Fruits in October.

Chloris polystachya, Roxb. Fl. Ind. I, 330.
Loc.: Jaisalmer and Jodhpur States (Erskine).
Distrib.: India.

Eleusine Gaertn.

Eleusine flagellifera, Nees in Linnæa XVI (1842) 220.
Vern. N.: Tantia.
Loc.: Jodhpur: Kailana (Nos. 4615 !, 4623a !, 4620 !), Balsamand (No. 4177 !), Balarwa (Nos. 4914a !, 4916 !), Mandor (Nos. 4744a !, 4000a !, 4005a !, 4754a !), Bhikamkor (Nos. 4601 !, 4692 !, 4155 !), Phalodi (Nos. 4167 !, 4944 !), Barmer, sand (No. 4673 !), Barmer (No. 4988 !). Jaisalmer: Between Bap and Phalodi (No. 4030 !), Bap (No. 4022 !), near Bap (No. 4041 !), Shihad, gravel (No. 4054 !), Shihad (No. 4058 !), Sodakoer, riverbed (No. 4078 !), near Loharki (Nos. 4839a !, 4073 !, 9345 !), Loharki (Nos. 4844 !, 4695 !), Jaisalmer (No. 4818a !), Jaisalmer, rocky plateau (No. 4119 !), N. of Jaisalmer (No. 4111 !), Vinjorai, dunes (Nos. 4789 !, 4924 !, 4920a !, 4799 !), Vinjorai (No. 4800 !).
Distrib.: N. Africa to India and Afghanistan.
Fruits in October and November.

Eleusine aegyptiaca, Desf. Fl. Atl. I, 85.
Vern. N.: Makra.
Loc.: Jodhpur: Jodhpur (No. 3913a !), Balsamand (No. 4175 !), Balarwa (Nos. 4912 !, 4197 !, 4895 !), Mandor (No. 3972 !), Bhikamkor (Nos. 4670 !, 4158 !). Jaisalmer: Bap (No. 4023 !), Shihad (No. 4059a !), Sodakoer (No. 4063 !), Loharki (No. 4049 !), Amarsagar (No. 4970a !, 8757 !), Bada Bag (No. 4836 !), Jaisalmer (No. 4184 !, 4806 !), Devikot (No. 4214 !).
Distrib.: Warm regions of the Old World, introduced into the New.
Fruits in October and November.

Eleusine aristata, Ehrenb. ex Boiss. Fl. Or. V, 557.
Loc.: Jodhpur: Jodhpur (Nos. 4682 !, 3911 !, 3914), Bhikamkor (No. 4661 !). Jaisalmer: Sodakoer, river bed (No. 4061 !), Amarsagar (Nos. 4973 !, 4966 !), Vinjorai, sandy plain (No. 3994 !).
Distrib.: Nubia, Arabia, Afghanistan, India.
Fruits in October and November.

Pappophorum Nees.

Pappophorum elegans, Nees in Wight Cat. n. 1771.

Loc.: Jodhpur: Jodhpur (Nos. 4622!, 8759!, 4626!, 4623!), Mandor (No. 4007!), Bhikamkor (No. 4604!). Jaisalmer: Shihad, gravel (No. 4057!), near Loharki (Nos. 4697!, 4066!, 4855!), N. of Jaisalmer (No. 4113!), Amarsagar (Nos. 4970!, 4183!, 4964!), Jaisalmer (No. 4979!), Jaisalmer, rocky plateau (No. 4126!), near Devikot (No. 4819a!).

Distrib.: India.

Fruits in October and November.

Pappophorum aucheri, Jaub. and Spach Ill. Pl. Or. IV, 32, t. 323.

Loc.: Jodhpur: Balsamand (Nos. 4003!, 4178!). Jaisalmer: N. of Jaisalmer (No.4117!) Jaisalmer, rocky plateau (No. 4130!), Vinjorai, rocks (No. 4745!).

Distrib.: Persia, Turkestan, Afghanistan, India.

Fruits in October and November.

Pappophorum robustum, Hook. f. in Hook. f. Fl. Brit. Ind. VII, 302.

Loc.: Jodhpur: Kailana tank (Nos. 4499!, 4982!, 4634!, 4633!) Balsamand (Nos. 4779a!, 4010!), Barmer, rocks (No. 4196!).

Distrib.: Upper Gangetic Plain, Rajputana.

Fruits in October and November.

Eragrostis Beauv.

Eragrostis ciliaris, Link En. Hort. Berol. I, 192.

Loc.: Jodhpur: (No. 3905a!), Mandor (No. 4014!), Osian (No. 4749!), Balarwa (Nos. 4905!, 4905a!), Bhikamkor (Nos. 4666!, 4655!, 4663!), Phalodi (Nos. 4162!, 4150!, 4949!). Jaisalmer: Shihad, gravel (No. 4055!), Sodakoer (No. 4796!), Loharki (No. 4842!), Jaisalmer, gravel (No. 4118!), Vinjorai, dunes (Nos. 4788!, 4786!, 4925!, 8753!), Vinjorai, sandy plain (No. 4219!), Devikot (Nos. 4208!, 4212!), Devikot, gravel (No. 4216!).

Distrib.: Tropical regions.

Fruits in October and November.

Eragrostis ciliaris var. brachystackya, Boiss. Fl. Or. V, 582.

Loc.: Jodhpur: Mandor (No. 4739!), Phalodi (No. 4017!). Jaisalmer: Bap (No. 4029!), Sodakoer, sandy plain (No. 4092!), Sodakoer, near tank (No. 4105!), Amarsagar (No. 4954!), near Devikot (Nos. 4817!, 4688a!), Devikot (No. 4202!).

Distrib.: Trop. Africa, Arabia, India.

Fruits in October and November.

Eragrostis viscosa, Trin. in Mem. Acad. Petersb. ser. VI, I (1831) 397.

Loc.: Jodhpur: Kailana (No. 4628!), Balsamand (No. 4178a!), Mandor (No. 3972!).

Distrib.: Trop. and S. Africa, India.

Fruits in October.

Eragrostis plumosa, Link En. Hort.Berol. I, 192.

Loc.: Jodhpur Balsamand (No. 8747!), Mandor (No. 4133a!). Jaisalmer: Between Phalodi and Bap (No. 4040!), Bada Bag (No. 8752!), Amarsagar (No. 4642!), Jaisalmer (No. 4700!).

Distrib.: Throughout India, Burma and Ceylon.

Fruits in October and November.

Eragrostis interrupta, Beauv. Agrost. 71.

Loc.: Jodhpur: Jodhpur (Nos. 4649!, 3912!, 8754!), Kailana, tank (Nos. 4487!, 3904a!), Balsamand (No. 4003a!), Mandor (Nos. 4001!, 4737!, 4001a!), Phalodi (Nos. 4168!, 4151!), S. E. of Luni

(No. 4051 !) Kotda, near Seu (Nos. 4653 !, 4787a !), Barmer, rocks (4873!), Barmer, wet ground (No. 4871 !). Jaisalmer : Between Phalodi and Bap, fields (No. 8751 !), Bap (No. 4021 !), Sodakoer, tank (No. 4098 !), Amarsagar (Nos. 4953 !, 4647 !, 4880 !), Jaisalmer (No. 4785 !), Jaisalmer, sand (No. 4819 !), near Devikot (Nos. 4828 !, 4832 !), Devikot, wet ground (No. 4814 !), Vinjorai, lake (No. 4779).

Distrib. : Trop. Africa, Mesopotamia, India, Burma.

Fruits in October and November.

Eragrostis stenophylla, Hochst. ex Miquel Analect. Bot. Ind. II, 27.

Loc. : Jaisalmer : Vinjorai, dunes (No. 4787 !).

Distrib. Trop. Africa and Asia.

Fruits in November.

Eragrostis tremula, Hochst. ex Steud. Syn. Gram. 269.

Loc. : Jodhpur : Jodhpur (Nos. 4686 !, 4680 !), Kailana, tank (No. 3902 !), Mandor (No. 4738 !), Osian (Nos. 4141 !, 4135, 4733 !), near Badka (No. 4048 !), Bhikamkor (No. 4591 !). Jaisalmer : Vinjorai, sand (No. 3987 !), Vinjorai (No. 4759 !).

Distrib. : Trop. Africa, Afghanistan, India.

Fruits in October and November.

Eragrostis maior, Host. Gram. Austr. IV, 14, t. 24.

Loc. : Jaisalmer : Bap (No. 4028 !).

Distrib. : Mediterranean, trop. and subtrop. Asia.

Fruits in October.

Eragrostis minor, Host. Gram. Austr. IV, 15.

Loc. : Jodhpur : Kailana (No. 4632 !), Bhikamkor (Nos. 5000 !, 4607 !), Barmer, sand (Nos. 4196a !, 4996 !). Jaisalmer : Between Phalodi and Bap (Nos. 4894 !, 4891 !), Loharki (No. 4691 !), Amarsagar (No. 4641 !, 4193 !), Jaisalmer (Nos. 4018 !, 4645 !), N. of Jaisalmer (No. 4113a !), Vinjorai, gravel (No. 4780a !), Vinjorai, rocks (No. 4782 !), near Devikot (No. 4815 !), Devikot, gravel (No. 4215 !).

Distrib. : Mediterranean, India, W. Tibet, N. Asia.

Fruits in October and November.

Eragrosteis pilosa, Beauv. Agros. 71.

Loc. : Jodhpur : Jodhpur (No. 4498 !), Balarwa (No. 4910 !), Bhikamkor (No. 4157 !), Mandor (No. 4742a!). Jaisalmer : Between Phalodi and Bap (No.4890!), Bap (No. 4027 !), Sodakoer, river bed (Nos. 4077 !, 4082!, 4083 !, 4085 !), Sodakoer, near tank (No. 4103 !), Jaisalmer, sand (No. 4818 !), Amarsagar (No. 4968 !), Vinjorai, wet ground (No. 4775!), Jaisalmer, wet ground (No.4783a !), Devikot (Nos. 4207!, 4205 !, 4210 !).

Distrib. : Most warm countries.

Fruits in October and November.

Desmostachya Stapf.

Desmostachya bipinnata, Stapf in Dyer Fl. Cap. VI (1900) 632.—*Eragrostis cynosuroides*, Beauv.

Loc. : Jodhpur : Osian (No. 4147 !), Bikamkor (No. 4671 !), Kotda near Seu (No. 4650 !). Jaisalmer : Between Phalodi and Bap (No. 4037 !), near Bap (No. 4046 !), Jaisalmer, wet ground (Nos. 4784 !, 4817a !), Amarsagar (Nos. 4967 !, 4187 !), Vinjorai, wet ground. (No. 4741 !).

Distrib. : Mediterranean to India.

Fruits in October and November.

Oropetium Erin.

Oropetium thomæum, Trin. Fund. Agrost. 98, t. 3.
Loc.: Jodhpur: Bhikamkor, wet ground (Nos. 4609 !, 4165 !). Kotda, rocks (No. 4792a !). Jaisalmer: Sodakoer (No. 4076 !), Bada Bag. (No. 4809 !), Amarsagar (No. 4191 !), Vinjorai, rocks (No. 4761 !).
Distrib.: India, Ceylon.
Fruits in October and November.

Triticum L.

Triticum vulgare, Vill. Hist. Pl. Dauph. II, 153.
Vern. N.: Ghau, Wheat.
Loc.: Cultivated in many places, especially in Jodhpur State.

Hordeum L.

Hordeum vulgare, L. Sp. Pl. 84.—Barley.
Loc.: Cultivated to some extent in both States.

CRYPTOGAMIA.

Filices.

Actinopteris dichotoma, Bedd.
Loc.: Jodhpur: Barmer, on rocks (No. 1140 !).
Distrib.: Mascarene Isl., N. Africa, Persia, Cabul, India, Ceylon.

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A TENTATIVE LIST OF THE VERTEBRATES OF THE JALPAIGURI DISTRICT, BENGAL.

BY

Chas. M. Inglis, M. B. O. U., W. L. Travers, H. V. O'Donel and E. O. Shebbeare, I. F. S.

Part II (With a Plate, Map and text-block.)

(*Continued from page* 825 *of Volume XXVI*).

BIRDS.

Jungle-Crow (4), *Corvus macrorhynchus.*—The common crow found in the forests.

Indian House-Crow (7), *Corvus splendens.*—Common, but only found in the bazaars and never in the forest.

Green Magpie (14), *Cissa chinensis.*—Fairly plentiful and met with in large flocks, also singly.

Indian Tree-pie (16), *Dendrocitta rufa.*—Very common.

Himalayan Tree-pie (18), *Dendrocitta himalayensis.*—Common in the hilly portion of the district; also occurs in fewer numbers in the plains. O'Donel has taken nests 9 miles from the hills.

Indian Grey Tit (31), *Parus atriceps.*—Very common.

Green-backed Tit. (34), *Parus monticola.*—Common round Buxa.

Yellow-billed Crow-Tit (51), *Paradoxornis flavirostris.*—Recorded from the "Bhutan Terai"; so far not observed by us.

Larger Red-headed Crow-Tit (52), *Psittiparus ruficeps.*—Inglis got this at Buxa early in March. There was a small party in some undergrowth.

[Hoary-headed Crow-Tit (61), *Psittiparus gularis gularis.*—Probably occurs above Buxa.]

Rufous-necked Laughing-Thrush (62), *Dryonastes ruficollis.*—The commonest Laughing-Thrush in the district.

Himalayan White-crested Laughing-Thrush (69), *Garrulax leucolophus leucolophus.*—Very common in the hills and also found in the plains at their base.

Black-gorgeted Laughing-Thrush (72), *Garrulax pectoralis.*—Noticed in the plains where it keeps to the forest.

Necklaced Laughing-Thrush (73), *Garrulax moniliger.*—Fairly common, especially round Gorumara keeping to the forest in fairly large flocks.

Rufous-chinned Laughing-Thrush (80), *Ianthocincla rufigularis rufigularis.*—Procured at Buxa.

Crimson-winged Laughing-Thrush (87), *Trochalopterum phœnicium phœnicium.*—Obtained at Buxa where they were got in the dense undergrowth.

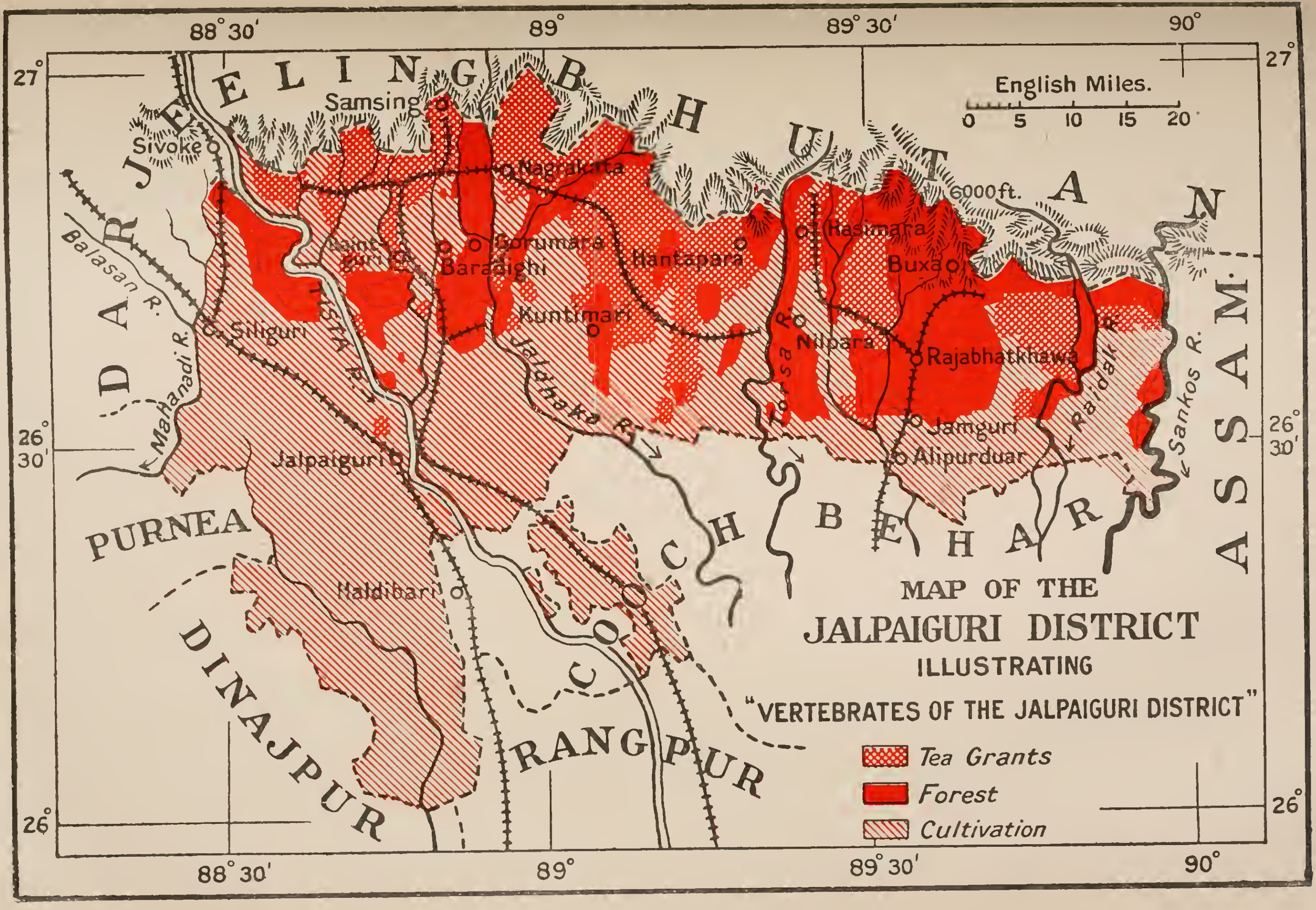
Striated Laughing-Thrush (101), *Grammatoptila striata striata.*—Shot at Buxa where it was fairly common in the undergrowth.

Striated Babbler (104), *Argya earlii.*—Fairly common on the churs of the Torsa.

Small Rufous Babbler (109), *Argya longirostris.*—Common in high grass.

Jungle Babbler (110), *Crateropus terricolor terricolor.*—Very common.

Slaty-headed Scimitar Babbler (116), *Pomatorhinus schisticeps schisticeps.*—Common in scrub jungle interspersed with grass, also in the forest in hills and plains.



MAP OF THE
JALPAIGURI DISTRICT
ILLUSTRATING
"VERTEBRATES OF THE JALPAIGURI DISTRICT"

88° 30′
89°
89° 30′
90°
27°
26° 30′
26°
English Miles.
0 5 10 15 20
DARJEELING
BHUTAN
ASSAM
COOCH BEHAR
PURNEA
DINAJPUR
RANGPUR
Sivoke
Samsing
Nagrakata
Borumara
Baradighi
Kuntimari
Hantapara
Rasimara
Buxa
Nilpara
Rajabhatkhawa
Jamguri
Alipurduar
Siliguri
Jalpaiguri
Haldibari
6000 ft.
Balasan R.
Mahanadi R.
Tista R.
Jaldhaka R.
Torsa R.
Raidak
Sankos R.
▨ Tea Grants
🟥 Forest
▨ Cultivation

E. O. Shebbeare.

Rusty-cheeked Scimitar Babbler (129), *Pomatorhinus erythrogenys erythrogenys.*—Common in the undergrowth round Buxa.

Bengal Red-capped Babbler (134), *Timelia pileata bengalensis.*—Very common in high grass or brushwood.

White-headed Shrike-Babbler (137), *Gampsorhynchus rufulus rufulus.*—Common at the base of the foot-hills, but does not appear to come down to the plains.

Yellow-eyed Babbler (139), *Pyctorhis sinensis sinensis.*—Common in grass land.

Hume's Babbler (141), *Pyctorhis altirostris griseigularis.*—Recorded from Bhutan and Buxa Duars.

Mandelli's Spotted Babbler (142), *Pellorneum ruficeps mandellii.*—Common in forest and thick brushwood.

Abbott's Babbler (160), *Malacocinla abbotti.*—Common in the forest and of a most confiding habit.

Black throated Babbler (169), *Stachyrhis nigriceps nigriceps.*—Shot at Buxa

Red-headed Babbler (172), *Stachyrhidopsis ruficeps ruficeps.*—Very common throughout the district keeping to forest and brushwood.

Stachyrhidopsis rufifrons ambigua (173 *a*).—Recorded from the Bhutan Duars.

Red-throated Tit-Babbler (180), *Schœniparus rufigularis.*—Recorded from the Bhutan Duars.

Long-billed Babbler (185), *Rimator malacoptilus.*—O'Donel met with a pair at about 4,000 ft., they were hopping about the ground in low-shrubs reminding him of *Pnœpyga* in their movements. Their flight seemed very weak and when disturbed they only flew a few yards.

Himalayan Whistling-Thrush (187), *Myiophoneus temmincki.*—Common, especially in the hills.

Slaty-bellied Short-wing (201), *Tesia cyaniventris.*—Very common at the foot-hills in winter, extending sparingly well into the plains.

Chestnut-headed Short-wing (202), *Oligura castaneicoronata.*—Shot at Buxa in the hills and a common winter visitor to the plains.

Long-tailed Sibia (203), *Sibia picaoides picaoides.*—Observed at Buxa, keeping in parties.

Black-headed Sibia (204), *Lioptila capistrata capistrata.*—Shot at Buxa in the hills and at Gorumara in the plains.

Rufous Bar-wing (211), *Actinodura egertoni egertoni.*—Keeps in parties in the undergrowth round Buxa.

Hume's Staphidia (217), *Staphidia striata rufigenis.*—Recorded from Bhutan Duars.

Blue-winged Siva (221), *Siva cyanuroptera cyanuroptera.*—Observed at Buxa.

Stripe-throated Yuhina (223), *Yuhina gularis gularis.*—A rare winter visitor to the plains.

Black-chinned Yuhina (225), *Yuhina nigrimentum.*—Shot at Buxa where they were seen in small parties. O'Donel found it common from 1,000 ft. upwards.

Indian White-eye (226), *Zosterops palpebrosa.*—Very common.

[Swinhoe's White-eye (228), *Zosterops simplex.*—Shebbeare thinks he got this, but is not certain about it.]

Chesnut-headed Ixulus (231), *Ixulus occipitalis.*—O'Donel met with this bird at about 3,000 ft. elevation.

Yellow-naped Ixulus (232), *Ixulus flavicollis flavicollis.*—Common in the hills, also descending to the plains.

White-bellied Herpornis (234), *Herpornis xantholeuca.*—Very common in the hills above Buxa and at the foot-hills, also occasionally extending to the plains in winter.

Red-winged Shrike-Tit (237), *Pteruthius erythropterus.*—O'Donel saw this bird at elevation over 4,000 ft.

Common Iora (243), *Ægithina tiphia.*—Very common.

Ruby-cheek (911), *Chalcoparia phœnicotis.*—Recorded from Bhutan Duars.

Gold-fronted Chloropsis (247), *Chloropsis aurifrons.*—Common.

Orange-bellied Chloropsis (249), *Chloropsis hardwickii.*—Fairly common.

Fairy Blue-bird (254), *Irena puella.*—Common in the foot-hills and occasionally straying well into the plains in the winter.

Sultan-bird (255), *Melanochlora sultanea.*—Common in the hills and foot-hills.

Red-tailed Minla (258), *Minla igneitincta.*—Several shot at Buxa in the company of other small birds.

Fire-cap (260), *Cephalopyrus flammiceps.*—Shot near the Sankos at plains level.

Spotted-wing (261), *Psaroglossa spiloptera.*—Very common along the base of the hills, occasionally descending to the plains.

White-throated Bulbul (263), *Criniger flaveolus.*—A resident species in the northern portion of the district. Very common in heavy forest.

Himalayan Black Bulbul (269), *Hypsipetes psaroides.*—Common in hills and plains, more in evidence in the plains in winter when large flocks visit the open country. Breeds in the foot-hills and plains. A nest seen by O'Donel in the foot-hills was placed at the end of a branch some 50 feet high; another, taken in the plains by O'Donel on the 13th May, was placed some 15 feet high and contained 3 highly incubated eggs.

Brown-eared Bulbul (272), *Hemixus flavala.*—Common along the base of the hills and as high as Buxa and extending sparingly into the plains in winter. It has a flute-like note.

Striated Green Bulbul (277), *Alcurus striatus.*—Common at the base of the hills and higher, but never seen in the plains. O'Donel found this bird common about 3,000 ft. elevation.

Bengal Red-vented Bulbul (282), *Molpastes bengalensis.*—Very common.

White-cheeked Bulbul (284), *Molpastes leucogenys.*—We believe we have seen this bulbul in the hills. It was very common near the base of the hills in the Darjiling Terai.

Bengal Red-whiskered Bulbul (288), *Otocompsa emeria.*—Very common.

Black-crested Yellow Bulbul (290), *Otocompsa flaviventris.*—Very common in the forest. It has a very pleasant trilling note.

Cinnamon-bellied Nuthatch (316), *Sitta cinnamomeiventris.*—Common. A resident species in the northern half of the plains, portion of the district. It breeds in April and May.

Velvet-fronted Blue Nuthatch (325), *Sitta frontalis.*—A common resident species.

Crow-billed Drongo (326), *Dicrurus annectens.*—Common during the summer, but not noticed during the winter. It breeds in May and June and during this season it has a most clear loud note and is just as aggressive as *D. ater.* Usually found in forest but will take up its residence in compounds where there are large trees.

Black Drongo (327), *Dicrurus ater*—Very common in open country.

Indian Ashy Drongo (328), *Dicrurus longicaudatus.*—Very common. O'Donel has seen this bird sit alongside a small beehive and deliberately pick off bees and swallow them.

Bronzed Drongo (334), *Chaptia ænea.*—Very common in forest. A splendid mimic.

Hiar-crested Drongo (335), *Chibia hottentotta.*—Very common in the forest; also very often seen outside especially on Simul trees when in flower. A handsome bird as often seen in pairs as parties.

Lesser Racket-tailed Drongo (339), *Bhringa remifer.*—Rather common in the dense forest.

Larger Racket-tailed Drongo (340), *Dissemurus paradiseus.*—Common in the forest; only noticed singly or in pairs, never in parties. A very fine mimic.

Wall Creeper (348), *Tichodroma muraria.*—They come down in winter to the gorges where the rivers break into the plains.

Brown Wren (357), *Pnoepyga pusilla.*—Common in the hills and also in the plains during the winter, keeping to the undergrowth.

Turkestan Grasshopper-Warbler (362), *Locustella straminea.*—Recorded from the Bhutan Duars.

Blyth's Reed-Warbler (366), *Acrocephalus dumetorum.*—A common winter visitor. During the upward migration in March and April more birds are seen ; quite a lot stay on to the end of May.

Burmese Bush-Warbler (370), *Tribura intermedia.*—Recorded from the Bhutan Duars. We have never seen it.

Spotted Bush-Warbler (371), *Tribura thoracica.*—Common in heavy grass and reed jungle during the winter.

Brown Bush-Warbler (373), *Tribura luteiventris.*—Recorded from the Bhutan Duars.

Indian Tailor-bird (374), *Orthotomus sutorius.*—Resident and common.

Black-necked Tailor-bird (375), *Orthotomus atrigularis.*—A forest species.

Yellow-headed Fantail-Warbler (379), *Cisticola tytleri.*—A common resident species. The male bird has a clear bell-like note during the breeding season. This note is often heard while sitting on some grass reed, but is generally heard high up in the air when the bird appears to spend hours circling round the neighbourhood of his nest.

Franklin's Wren-Warbler (382), *Franklinia gracilis.*—Resident and common. A sprightly cheery little bird moving about in small parties.

[Beavan's Wren-Warbler (383), *Franklinia rufescens.*—Probably found.]

Hodgson's Wren-Warbler (385), *Franklinia cinereicapilla.*—Procured by Mandelli in the Bhutan Duars.

Large Grass-Warbler (388), *Graminicola bengalensis.*—Resident, but rather uncommon.

Striated Marsh-Warbler (389), *Megalurus palustris.*—Recorded from Bhutan and Buxa Duars.

Thick-billed Warbler (393), *Arundinax áëdon.*—A fairly common winter visitor to the plains.

Brown Willow-Warbler (407), *Phylloscopus tristis.*—A cold weather visitor.

Smoky Willow-Warbler (409), *Phylloscopus fuliginiventris.*—A cold weather visitor.

Dusky Willow-Warbler (410), *Phylloscopus fuscatus.*—A cold weather visitor.

Orange-barred Willow-Warbler (414), *Phylloscopus pulcher.*—Shot at Buxa during the winter.

Green Willow-Warbler (421), *Acanthopneuste nitidus*—Seen in the cold weather.

Blyth's Crowned Willow-Warbler (429), *Acanthopneuste trochiloides.*—A winter migrant.

Black-browed Flycatcher-Warbler (433), *Cryptolopha burkii.*—A very common winter visitor to the plains.

Tickell's Flycatcher-Warbler (438), *Cryptolopha cantator.*—Shot at Buxa during the cold weather.

Strong-footed Bush-Warbler (448), *Horornis fortipes.*—Rather an uncommon winter visitor to the plains.

Blanford's Bush-Warbler (451), *Horornis pallidipes.*—A winter visitor.

Golden-headed Warbler (454), *Phyllergates coronatus.*—A rare bird. O'Donel has only seen two at Hasimara during a number of years. It is possibly only a winter visitor in the plains.

Yellow-bellied Wren-Warbler (463), *Prinia flaviventris.*—Resident and common.

Ashy Wren-Warbler (464), *Prinia socialis.*—Resident and very common.

Jungle Wren-Warbler (465), *Prinia sylvatica.*—Resident and common. This species is usually found in light forest interspersed with grass ; the other species of *Prinia* found being essentially grass birds.

Indian Wren-Warbler (466), *Prinia inornata*..—Resident.

Black-headed Shrike (475), *Lanius nigriceps*.—Very common and the one resident Shrike in the plains.

Grey-backed Shrike (477), *Lanius tephronotus*.—A common winter visitor to the plains.

Pale-brown Shrike (479), *Lanius isabellinus*.—Sparingly distributed in the plains during the winter.

Brown Shrike (481), *Lanius cristatus*.—A common winter visitor to the plains.

Black-backed Pied Shrike (484), *Hemipus picatus*.—Resident, but not often met with. It moves about in small parties keeping to forest.

Nepal Wood-Shrike (486), *Tephrodornis pelvicus*.—Probably a resident species even in the plains. It keeps to large flocks in the winter which break up into pairs in April and May. O'Donel has noted stray pairs in June, 8 miles from the hills.

Common Wood-Shrike (488), *Tephrodornis pondicerianus*—Common and resident.

Indian Scarlet Minivet (490), *Pericrocotus speciosus*.—Common in the hills and foot-hills and their immediate base and moving well into the plains in the winter.

Short-billed Minivet (495), *Pericrocotus brevirostris*.—Not at all uncommon. Several were shot at Rajabhatkhawa in February.

Yellow-throated Minivet (498), *Pericrocotus solaris*.—Rather uncommon, but resident in the hills and plains.

Rosy Minivet (499), *Pericrocotus roseus*.—Resident and fairly common in the hills and plains.

Small Minivet (500), *Pericrocotus peregrinus*.—Resident and common everywhere.

Dark-grey Cuckoo Shrike (505), *Campophaga melanoschista*.—Fairly common and resident in the plains, but less so during the winter when some birds move southwards. Breeds in the plains and the hills during June and July; the song at this season is a clear whistle like "*tweet, tweet, teeor*."

Black-headed Cuckoo-Shrike (508), *Campophaga sykesi*.—Uncommon and only noted in summer.

Large Cuckoo-Shrike (510), *Graucalus macii*.—Resident and common.

Ashy Swallow-Shrike (512), *Artamus fuscus*.—Common and resident. O'Donel has noted birds during every month of the year.

Burmese Black-naped Oriole (515), *Oriolus tenuirostris*.—Rather rare; so far we have only noted it during the winter, but Mr. Primrose shot one at Lankapara in August.

Indian Black-headed Oriole (521), *Oriolus luteolus*.—Resident and common.

Maroon Oriole (522), *Oriolus trailii*.—Resident and common. It extends well in to the plains keeping to heavy forest.

Indian Grackle (524), *Eulabes intermedia*.—Resident. Common in the hills and foot-hills.

Common Indian Starling (532), *Sturnus menzbieri*.—Occasionally seen in the cold weather.

Grey-headed Myna (538), *Sturnia malabarica*.—Resident and the commonest Myna in the district.

Common Myna (549), *Acridotheres tristis*.—Common and resident.

Bank Myna (551), *Acridotheres ginginianus*.—Found in the banks of some of the rivers.

Jungle Myna (552), *Æthiopsar fuscus*.—Common and resident.

Pied Myna (555), *Sturnopastor contra*.—Fairly common and resident.

Sooty Flycatcher (558), *Hemichelidon sibirica*.—A not uncommon visitor to the plains.

Orange-gorgetted Flycatcher (560), *Siphia strophiata*.—Shot at Buxa.

European Red-breasted Flycatcher (561), *Siphia parva*.—A winter visitor to the plains.

A stream rising in the hills, the jungle on the banks being the resort of *Pavo cristatus*, the Common Peafowl, *Gallus ferrugineus*, the Red Jungle-fowl, &c., and the sand and stones that of *Œdicnemus scolopax*, the Stone-Curlew, and other waders.

Near view of forest along the banks of a river. Haunts of *Ketupa Zeylontensis*, the Brown Fish-Owl, *Polioaëtus humilis*, Hodson's Fishing Eagle, &c.

THE VERTEBRATES OF THE JALPAIGURI DISTRICT, BENGAL.

Eastern Red-breasted Flycatcher (562), *Siphia albicilla.*—A common winter visitor to the plains.

Slaty-blue Flycatcher (567), *Cyornis leucomelanurus.*—A very common winter visitor to the plains. It is found in any sort of jungle both in high grass and thick forest.

Little Pied Flycatcher (569), *Cyornis melanoleucus.*—A fairly common winter visitor to the plains. It keeps to the forest.

Blue-throated Flycatcher (575), *Cyornis rubeculoides.*—Not uncommon along the base of the hills.

Pigmy Blue Flycatcher (578), *Nitidula hodgsoni.*—Only one specimen procured by Inglis at Buxa early in March.

Verditer Flycatcher (579), *Stoparola melanops.*—A winter visitor to the plains.

Brook's Flycatcher (586), *Anthipes poliogenys.*—Fairly common and resident. It keeps generally to tree jungle.

Brown Flycatcher (588), *Alseonax latirostris*—Probably resident. O'Donel has got specimens in July.

Grey-headed Flycatcher (592), *Culicicapa ceylonensis.*—A common winter visitor to the plains.

Rufous-bellied Niltava (594), *Niltava sundara.*—A not uncommon winter visitor to the plains. It keeps to thick scrub and forest.

Small Niltava (595), *Niltava macgrigoriæ.*—A very common winter visitor to the plains.

Burmese Paradise Flycatcher (599), *Terpsiphone affinis.*—Very common in the forests at the foot of the hills.

Indian Black-naped Flycatcher (601), *Hypothymis azurea.*—Common and resident in the plains throughout the year.

Yellow-bellied Flycatcher (603), *Chelidorhynx hypoxanthum.*—Very common in the hills and a common winter migrant to the plains. It keeps to forest.

White-browed Fantail Flycatcher (604), *Rhipidura albifrontata.*—A common resident species.

White-throated Fantail Flycatcher (605), *Rhipidura albicollis.*—Very common in the plains. It is one of the birds always seen while sitting over a kill for a tiger. They very often come and pick insects from off the kill.

Common Pied Bush-Chat (608), *Pratincola caprata.*—Resident in the southern portion of the district, never near the hills.

Indian Bush Chat (610), *Pratincola maura.*—A common winter visitor to the plains.

White-tailed Bush Chat (611), *Pratincola leucura.*—Common in the grass churs of the Torsa river.

Hodgson's Bush Chat (613), *Pratincola insignis.*—A winter visitor.

[Jerdon's Bush Chat (614), *Oreicola jerdoni.*—Recorded from the adjoining district Purneah. We have not seen it.]

Dark-grey Bush Chat (615), *Oreicola ferrea.*—A common winter visitor to the plains.

Western Spotted Forktail (630), *Henicurus maculatus.*—Confined to the hill streams. Inglis got it at Buxa early in March.

Slaty-backed Forktail (632), *Henicurus schistaceus.*—A common winter visitor to the plains. It keeps mostly to forest streams.

Black-backed Forktail (633), *Henicurus immaculatus.*—Common in the forest streams.

Leschenault's Forktail (634), *Henicurus leschenaulti.*—Occasionally seen in the. winter.

Little Forktail (637), *Microcichla scouleri.*—Seen in the hills.

White-capped Redstart (638), *Chimarrhornis leucocephalus.*—Common in the hills and descends in winter along the principal rivers in the plains; never seen further than six miles from the hills.

Daurian Redstart (641), *Ruticilla aurorea.*—An occasional cold weather visitor

Hodgson's Redstart (643), *Ruticilla hodgsoni.*—An uncommon winter visitor to the plains; usually keeping to the principal river beds. Inglis got one near a small stream at Nilpara.

Indian Redstart (644), *Ruticilla rufiventris.*—Only noted in the plains during the upward migration in April and May.

Plumbeous Redstart (646), *Rhyacornis fuliginosus.*—A common winter visitor to the plains. It usually keeps to the principal rivers, but Inglis got it in a small stream at Kuntimari some 17 or 18 miles from the hills.

Indian Blue-throat (647), *Cyanecula suecica.*—A winter visitor.

Common Ruby-throat (650), *Calliope camtschatkensis.*—A rather uncommon winter visitor.

Tibet Ruby-throat (652), *Calliope tschebaiewi.*—A very common winter visitor to the plains.

Red-flanked Bush Robin (654), *Ianthia rufilata.*—Shot in the hills at Buxa early in March.

White-tailed Blue Robin (659), *Notodela leucura.*—Shot at Jamguri, 14 miles from the foot of the hills.

Magpie-Robin (663), *Copsychus saularis.*—Resident and very common.

The Shama (664), *Cittocincla macrura.*—Resident and common.

[Dusky Ouzel (674), *Merula fuscata.*—A specimen recorded from Bhutan Duars is considered by Oates to be *M. atrigularis.*]

Grey-winged Ouzel (676), *Merula boulboul.*—Common in the hills and also a common winter visitor to the plains. O'Donel has found it 20 miles from the foot-hills.

Black-throated Ouzel (677), *Merula atrigularis.*—A very common winter visitor to the plains.

Pied Ground-Thrush (683), *Geocichla wardi.*—Has been recorded from the Bhutan Duars.

Orange-headed Ground-Thrush (686), *Geocichla citrina.*—Fairly common and resident in the plains.

Chestnut-bellied Rock-Thrush (690), *Petrophila erythrogastra.*—A rare winter visitor to the plains and not seen further than 8 miles from the hills. It keeps to forest.

Eastern Blue Rock-Thrush (692), *Petrophila solitaria.*—Common winter visitor to the plains. It keeps a lot to river beds but, is also got in compounds; nearly all the forest bungalows have one of these birds in the cold weather.

Western Blue Rock-Thrush (693), *Petrophila cyanus.*—A winter visitor.

Small-billed Mountain-Thrush (698), *Oreocincla dauma.*—So far only noted in winter in the plains; it generally keeps to the forest. but has been seen away from it at Nilpara.

[Large Brown Thrush (704), *Zoothera monticola.*—Only seen in the Terai.]

Lesser Brown Thrush (705), *Zoothera marginata.*—Fairly common in certain areas of forest though absent from others equally suitable. It is probably resident.

Brown Dipper (709), *Cinclus asiaticus.*—Has occasionally been noticed in the hills

Eastern Baya (721), *Ploceus atrigula.*—Resident and common.

Large-billed Baya (721*a*), *Ploceus megarhynchus.*—O'Donel found a colony of these birds breeding at Hasimara in June 1912. The nests were quite different in shape to those of *P. atrigula*, being more or less rounded and attached to the tree in two or more places, with the entrance holes in the sides. Probably this species occurs right along the base of the Himalayas. He has never got the birds again.

Chestnut-bellied Munia (726), *Munia atricapilla.*—Fairly common in grass land.

Hodgson's Munia (727), *Uroloncha acuticauda.*—Scattered thoughout the northern part of the district.

Spotted Munia (735), *Uroloncha punctulata.*—Very common.

Indian Red Munia (738), *Sporæginthus amandava.*

Scarlet Finch (751), *Hæmatospiza sipahi.*—Only seen in the hills when it was shot at Buxa by Inglis on the 26th February.

Common Rose Finch (761) *Carpodacus erythrinus.*—Very sparingly distributed in the plains in the winter, but more in evidence during the upward migration in April and May.

House-Sparrow (776), *Passer domesticus.*—Very common near habitations.

[Tree-Sparrow (779), *Passer montanus.*—Only seen in the Terai.]

Cinnamon Tree-Sparrow (780), *Passer cinnamomeus.*—O'Donel has found it visiting the plains in large flocks during the winter, keeping generally to light forest.

Dwarf Bunting (791), *Emberiza pusilla.*—A fairly common winter visitor to the plains.

Yellow-breasted Bunting (797), *Emberiza aureola.*—An occasional cold weather visitor. It occurs in flocks.

Chestnut Bunting (801), *Emberiza rutila.*—Recorded from Bhutan Duars.

Crested Bunting (803), *Melophus melanicterus.*—Fairly common in November and December, but disappears for the rest of the year.

Indian Sand-Martin (809), *Cotile sinensis.*—Very common along the bank of the large rivers.

The Swallow (813), *Hirundo rustica.*—A common winter visitor.

Eastern Swallow (814), *Hirundo guttaralis.*—Common in the winter.

Tytler's Swallow (815), *Hirundo tytleri.*—Common in the winter.

Wire-tailed Swallow (818), *Hirundo smithii.*—Common in the winter.

Hodgson's Striated Swallow (822), *Hirundo nepalensis.*—A common winter visitor.

Syke's Striated Swallow (823), *Hirundo erythropygia.*—Common and the only resident species in the plains.

White Wagtail (826), *Motacilla alba.*—A common winter visitor to the plains.

Hodgson's Pied Wagtail (830), *Motacilla hodgsoni.*—Common in the plains during the winter.

Large Pied Wagtail (831), *Motacilla maderaspatensis.*—Rather uncommon.

Grey Wagtail (832), *Motacilla melanope.*—Common in the plains during the winter.

Grey-headed Wagtail (833), *Motacilla borealis.*—Common during the winter in the plains.

Yellow-headed Wagtail (837), *Motacilla citreola.*—Common during the winter in the plains. This appears to be the earliest arrival. O'Donel has seen it as early as the 11th August.

Forest Wagtail (839), *Limonidromus indicus.*—A rare winter visitor to the plains.

Indian Tree-Pipit (841), *Anthus maculatus.*—Common during the winter in the plains.

Brown Rock-Pipit (844), *Anthus similis.*—Recorded from as far east as the Sikkim Terai.

Richard's Pipit (845), *Anthus richardi.*—Common during the winter in the plains.

Blyth's Pipit (846), *Anthus striolatus.*—Common during the winter in the plains.

Indian Pipit (847), *Anthus rufulus.*—Common and resident in the plains.

Indian Sky Lark (861), *Alauda gulgula.*—Common in the southern part of the district.

Ganges Sand Lark (866), *Alaudula raytal.*—A few pairs are to be met with in the beds of the larger river.

Bengal Bush Lark (870), *Mirafra assamica.*—Resident and common in the tea.

Himalayan Yellow-backed Sunbird (882), *Æthopyga seheriæ.*—A common resident species in the hills and plains.

Fire-tailed Yellow-backed Sunbird (887), *Æthopyga ignicauda.*—Inglis got this species at Buxa in February and early March.

Mrs. Gould's Yellow-backed Sunbird (888), *Æthopyga gouldiae.*—Common at the base of the hills, but does not appear to extend to the plains.

Black-breasted Yellow-backed Sunbird (890), *Æthopyga saturata.*—Occurs in both hills and plains.

Purple Sunbird (895), *Arachnechthra asiatica.*—Common and resident in the plains.

Larger Striated Spider-hunter (906), *Arachnothera magna.*—Common and extending well into the plains during the winter.

Little Spider-hunter (909), *Arachnothera longirostris.*—Inglis shot this in the plains at Gorumara on the 19th January.

Scarlet-backed Flower-pecker (912), *Dicaeum cruentatum.*—Common in the plains.

Fire-breasted Flower-pecker (915), *Dicaeum ignipecius.*—Observed in the hills.

Plain-coloured Flower-pecker (917), *Dicaeum olivaceum.*—Common in the hills and their bases, but does not, we believe, extend into the plains.

Tickell's Flower-pecker (919), *Dicaeum erythrorhynchus.*—Seen in the plains.

Blue-naped Pitta (927), *Pitta nepalensis.*—Common in the plains during the winter. A great skulker and seldom seen.

Indian Pitta (933), *Pitta brachyura.*—Scarce and only noted in May.

Green-breasted Pitta (935), *Pitta cucullata.*—Common in the hills and at their immediate base, but not seen in the plains. Shebbeare, however, believes he saw a nest of this species in the plains.

Hodgson's Broadbill (943), *Serilophus rubripygius.*—Scattered along the foot-hills extending further into the plains during the cold weather, having been obtained at Rajabhatkhana during that season; it goes about in parties.

Long-tailed Broadbill (944), *Psarisomus dalhousiæ.*—Common in the hills and extending well into the plains in winter.

Black-naped Woodpecker (950), *Gecinus occipitalis.*—Common in the plains.

Small Himalayan Yellow-naped Woodpecker (951), *Gecinus chlorolophus.*—Appears to be resident. A very common species in the forest.

Large Yellow-naped Woodpecker (955), *Chrysophlegma flavinucha.*—Observed in the forest at close quarters but not shot.

Fulvous-breasted Pied Woodpecker (967), *Dendrocopus macii.*—Very common in the plains.

Darjiling Pigmy Woodpecker (973), *Iyngipicus semicoronatus.*—Occasionally seen in the plains.

Himalayan Pigmy Woodpecker (974), *Iyngipicus pygmæus.*—Occurs in the plains.

Red-eared Bay Woodpecker (978), *Pyrrhopicus pyrrhotis.*—Uncommon in the plains and usually keeps to the dark portions of the forest.

Northern Rufous Woodpecker (983), *Micropternus phæoceps.*—Common in the forest in the plains.

Himalayan Golden-backed Three-toed Woodpecker (989), *Tiga shorei.*—Uncommon but resident in the plains.

Tickells' Golden-backed Woodpecker (992), *Chrysocolaptes gutticristatus.*—Very common.

Speckled Piculet (1001), *Picumnus innominatus.*—Common in the foot-hills, occasionally seen in the plains.

Rufous Piculet (1002), *Sasia ochracea.*—Common in the foot-hills, also seen in the plains. O'Donel took a nest containing 3 eggs on the 27th April, from a 4-foot bamboo stump.

Common Wryneck (1003), *Iynx torquilla.*—Apparently only passes through the district on migration.

Great Himalayan Barbet (1006), *Megalæma marshallorum.*—Common in the hills and extends to the plains in the eastern part of the district where O'Donel has found it 8 miles from the hills. It keeps to the forest.

Lineated Barbet (1009), *Thereiceryx lineatus.*—Very common throughout the district.

Blue-throated Barbet (1012), *Cyanops asiatica.*—The commonest barbet in the district.

[Ruddy Barbet (1012*a*), *Cyanops rubescens.*—Mr. Primrose shot this in the Terai. We have not found it but is a bird easily passed over unless shot.]

Blue-eared Barbet (1016), *Cyanops cyanotis.*—Uncommon.

Crimson-breasted Barbet (1019), *Xantholæma hæmatocephala.*—Rather uncommon.

Indian Roller (1022), *Coracias indica.*—Very common.

Burmese Roller (1023), *Coracias affinis.*—Inglis got this species at Nilpara on the 4th February.

Broad-billed Roller (1025), *Eurystomus orientalis.*—Nowhere common and keeps to high forest.

Common Indian Bee-eater (1026), *Merops viridis.*—Very common.

Blue-tailed Bee-eater (1027), *Merops philippinus.*—Visits the district in considerable numbers in June and July after which it disappears.

A stream rising in the plains. The haunts of *Pelargopsis gurial*, the Brown-headed Stork-bellied Kingfisher, *Alcedo ispida*, the Common Kingfisher, *Plotus melanogaster*, the Indian Darter or Snake-bird, &c.

Chestnut-headed Bee-eater (1030), *Melittophagus swinhœi.*—Common in the plains. It is only met with in forest.

Blue-bearded Bee-eater (1031), *Nyctiornis athertoni.*—Common in the plains. It nests in any bank of a stream or a road cutting.

Indian Pied Kingfisher (1033), *Ceryle varia.*—Common.

Himalayan Pied Kingfisher (1034), *Ceryle lugubris.*—Extends well into the plains along the principal rivers, even some 13 or 14 miles from the foot-hills.

Common Kingfisher (1035), *Alcedo ispida.*—Common.

Beavan's Kingfisher (1036), *Alcedo beavani.*—Only found in the forest. Several were seen and shot at Rajabhatkhawa.

Three-toed Kingfisher (1040), *Ceyx tridactyla.*—Only got in the forest during the rains.

Brown-headed Stork-billed Kingfisher (1043), *Pelargopsis gurial.*—Common.

White-breasted Kingfisher (1044), *Halcyon smyrnensis.*—Common.

[Ruddy Kingfisher (1046), *Callialcyon lilacina.*—Only shot in Goalpara but we think we have observed it here.]

Great Hornbill (1051), *Dichoceros bicornis.*—Very common in the hills where large parties of about 30 birds were seen ; they were rather shy. It is also common along the foot-hills. The call during the breeding season is a loud *tock, tock,* uttered at slow but regular intervals.

Indo-Burmese Pied Hornbill (1053), *Anthracoceros albirostris.*—Common in the forest.

Malayan Wreathed Hornbill (1054), *Rhytidoceros undulatus.*—Mr. J.R. Phillips of the Bengal Police kindly sent Inglis the skin of a female of this bird taken from a nest near Buxa. The nest was in a very large tree, called *Myna Kat* (*Tetrameles nudiflora*) by the natives and was situated about 100 feet from the ground. The tree was in thin hill forest, on a high hill about 4,000 feet elevation and in a lonely place about 2 miles S. E. of Buxa and about a mile from the unfrequented Jainti road. It was first discovered about the 1st May, but the men were unable to reach it. Owing to Mr. Phillips being away from Buxa an interval of over three weeks lapsed before the men tried again and this time on the 26th May, they were successful in reaching the nest. There was a single young one inside without any feathers and with closed eyes. They killed the female and took both her and the young one to Mr. Phillips. He kept the young one for some time and when it died also sent its skin to Inglis. O'Donel thinks he has seen this species flying over Chuapara in the plains.

Rufous-necked Hornbill (1057), *Aceros nepalensis.*—Due to the great trouble taken and generosity of Mr. Phillips, we can now put down this hornbill as occurring in this district. About the end of November 1918, Mr. Phillips sent Inglis a skin of this species He had purchased the living bird at Buxa and kept it alive for some time. It was a male. From Buxa itself Mr. Phillips has now sent Inglis three hornbills.—*Dichoceros bicornis, Rhytidocerus undulatus* and *Aceros nepalensis*—and it is due to his energy that we have been able to certify the occurrence of the two latter.

Common Grey Hornbill (1062), *Lophoceros birostris.*—Uncommon. O'Donel has always observed them in the open country.

European Hoopoe (1066), *Upupa epops.*—A winter visitor.

Indian Hoopoe (1067), *Upupa indica.*—Common.

Alpine Swift (1068), *Cypselus melba.*—Uncommon.

Large White-rumped Swift (1071), *Cypselus pacificus.*—Very common in the plains during June and July.

Common Indian Swift (1073), *Cypselus affinis.*—Common.

Palm-Swift (1075), *Tachornis batassiensis.*—Common.

White-necked Spine-tail (1077), *Chætura nudipes.*—Very common.

Himalayan Swiftlet (1082), *Collocalia fuciphaga.*—Extends well in to the plains ; O'Donel having noticed it some distance from the hills.

Indian Crested Swift (1086), *Macropteryx coronata.*—Rather uncommon. O'Donel has seen large flocks hawking insects during the winter.

Franklin's Nightjar (1090), *Caprimulgus monticola.*—Uncommon. A specimen from the Bhutan Duars which is in the British Museum was got in April.

Horsfield's Nightjar (1093), *Caprimulgus macrurus.*—Very common. This is the subspecies of *C. albonotatus.*

Red-headed Trogon (1101), *Harpactes erythrocephalus.*—Found in the hills and the plains keeping to the dense forest.

European Cuckoo (1104), *Cuculus canorus.*—Occurs in the plains but is very seldom heard calling.

Himalayan Cuckoo (1105), *Cuculus saturatus.*—Occurs in the plains during September and October.

Indian Cuckoo (1107), *Cuculus micropterus.*—Very common. The earliest date on which O'Donel has heard it calling was the 27th March. It continues to call up to the beginning of July.

Common Hawk-Cuckoo (1109), *Hierococcyx varius.*—Very common.

Indian Plaintive Cuckoo (1112), *Cacomantis passerinus.*—Uncommon.

Rufous-bellied Cuckoo (1113), *Cacomantis merulinus.*—Uncommon.

Banded Bay Cuckoo (1114), *Penthoceryx sonnerati.*—Rare in the plains but appears to be resident.

[Violet Cuckoo (1115), *Chrysococcyx xanthorhynchus.*—Shot in the adjoining district Goalpara where it was far from rare.]

Drongo Cuckoo (1117), *Surniculus lugubris.*—Very common in the plains. It resembles *Dicrurus annectens* but lacks the sprightly appearance of that bird.

Pied Crested Cuckoo (1118), *Coccystes jacobinus.*—Common in the plains from April to November.

Red-winged Crested Cuckoo (1119), *Coccystes coromandus.*—Very common in the foot-hills and extends well in to the plains, keeping to the forest.

Indian Koel (1120), *Eudynamis honorata.*—Scarce in the northern part of the district, common in the south.

Large Green-billed Malkoha (1123), *Rhopodytes tristis.*—Common but not easily seen. It is a picturesque sight to see a pair of these birds fly across an opening in the forest with their long tails streaming out behind. They are said to feed on the ground but we havn't found them doing so.

Sirkeer Cuckoo (1129), *Taccocua leschenaulti.*—Recorded from the Bhutan Duars.

Common Coucal (1130), *Centropus sinensis.*—Common.

Lesser Coucal (1133), *Centropus bengalensis.*—Commoner than the last in the northern half of the district.

Large Indian Paroquet (1135), *Palæornis nepalensis.*—Rather common in the forest. Large numbers were seen at Gorumara and Kuntimari.

Large Burmese Paroquet (1136), *Palæornis indoburmanicus.*—Most birds obtained here seem to be intermediate between these two species.

Rose-ringed Paroquet (1138), *Palaeornis torquatus.*—Very common.

Western Blossom-headed Paroquet (1139), *Palæornis cyanocephalus.*—Fairly common.

Eastern Blossom-headed Paroquet (1140), *Palæornis rosa.*—Noticed in the cold weather.

Red-breasted Paroquet (1145), *Palaeornis faciatus.*—Very common.

Indian Loriquet (1150), *Loriculus vernalis.*—Recorded from Sikkim and Bhutan Duars but not observed by us.

(*To be continued.*)

THE BIRDS OF PREY OF THE PUNJAB

BY

C. H. DONALD, F. Z. S.

PART IV.

(*Continued from page 835 of Vol. XXVI.*)

TYPE F.

FAMILY FALCONIDÆ.

SUBFAMILY FALCONINÆ.

Genus BUTEO.

No. 1240. *Buteo leucocephalus.* The Upland Buzzard.

Characteristics. Tarsus about 3·5, feathered for about two-thirds its length, naked part in front reticulated; wing over 16″; irides white or buff.

Colouration. "Colouration above rather pale greyish-brown, with more or less rufous on the feathers of the nape and upper back, scapulars, wing-coverts, and upper tail-coverts; white bases of feathers often conspicuous on the head and neck, which are sometimes white streaked with brown; quills as in *B. ferox*, but there is no grey on the outer webs of the primaries; tail brown above, with dark bars, paler below, whitish near the shafts and towards the base, sometimes bordered with rufous; lower parts white, the throat streaked with brown; upper breast and abdomen with large brown spots irregularly distributed, sometimes edged with rufous; lower breast as a rule white; the upper breast, flanks and thigh-coverts often entirely brown, and sometimes, as in Hodgson's type, the whole breast and abdomen. No rufous or fuliginous phase is known" (Blanford.)

"Bill bluish horny; irides white; legs and feet wax-yellow. (Henderson.) Cere greenish-yellow; irides light buff." (Shanghai Mus. label).

Measurements. "Length of a female 25·5; tail 10·75; wing 19·20; tarsus 3·5; mid-toe without claw 1·8; bill from gape 2."

Habits, etc. Little or nothing appears to be known about this species and only two or three specimens have been procured, in the Himalayas. One from Native Sikhim and the other from the Pir Panjal Range, in Kashmir.

It appears to be a more robust bird than *B. ferox* with larger bill and feet and more powerful claws.

The difference in the feathering of the tarsi and the curious white or pale buff eye should differentiate it from the last species. I have never seen it to my knowledge, so cannot describe its flight.

Nothing appears to be known regarding its nidification.

Genus *Buteo*.

No. 1241. *Buteo desertorum.* The Common Buzzard.

Characteristics. Tarsus *under* 3″, feathered for about ½ its length or a little over, naked part in front *usually* scutellate. Wing under 16″; irides brown.

Colouration. *As in B. ferox* very variable, individuals varying from dark to light brown on the upper parts, with a darker shaft-stripe to each feather, and a rufous margin.

This latter is particularly noticeable in young birds. "Sides of head paler than crown, usually more or less streaked brown, the streaks generally forming a dark or blackish moustachial stripe from the gape, and frequently another streak running back from the eye. Primary quills with long dark brown or blackish ends, all the remainder white beneath the wing, brown on the outer web above, rufous or white on the inner and more or less barred and mottled."

The white portion of the primaries makes a most conspicuous patch, seen only when the bird flies.

The lower parts vary from almost white to a rufous-brown, with irregular spots on breast and abdomen and long dark streaks on the throat. "The flanks and thigh-coverts and sometimes the abdomen all brown, or the two latter brown with more or less indistinct white or buff bars."

There is also the dark phase of plumage which is "dark smoky or chocolate brown throughout, except the bases of the quills, which are white or whity-brown mottled and barred darker, and the tail, which is banded with light brown." (Blanford.)

"Bill black, bluish-grey towards the base; cere yellow: irides brown; legs and feet yellow." (Blanford.)

Measurements. Length of female about 20″; tail 9″; wing 15½″; tarsus 2·8″. Males are less, wing 14·5″. (Blanford). Expanse about 4 feet.

Habits, etc. This species is said to come down to the plains during the winter months, but I cannot say that I have ever seen one. Out of some 25 to 30 Buzzards which I have caught at various times, I have not succeeded in getting any other species than *B. ferox*, on the plains nor *B. desertorum* in the hills. Of course *B. ferox* is very common among the lower hills throughout the winter, but I here refer to the higher ranges, between 8,000 feet and 11,000 feet above sea level, where the Common Buzzard is usually to be found.

Throughout the Himalayas, from Kashmir to Bushahr (in the Simla District), I have found this species, or at any rate what I have taken for granted is this species, from its smaller size, whereas the few I have caught have proved to be so. On the margins of open glens, surrounded by thick forest, or on the outskirts of Alpine pastures, and frequently in grassy "nallahs" are places where this bird may be found.

It is, I think, more given to soaring than is *B. ferox* and is often to be seen circling high above the trees for considerable periods at a time.

After attaining a good height, it has a way of closing its wings and dropping at a tremendous pace, as though after some quarry, but it usually ends up by alighting on some convenient tree, overlooking a glade, where, like *B. ferox,* it will sit by the hour, waiting for a vole to turn up.

In the spring a pair might often be seen stooping at each other and again in the autumn, when the youngsters are being initiated in the art of flying.

Many years ago, while hunting for brown bear, the writer came upon a most unusual scene. My attention was attracted by several of these birds, at least 12 or 15, all on one little woodland glen, a curious enough occurrence in itself. Several were sitting on rocks in the centre of the open patch of country while others were on trees or flying round above. I promptly took cover to see what had attracted them and shortly after a few crows arrived on the scene. It appeared to be a sort of gathering of voles which had attracted them, and I don't think I have seen so many voles in the whole course of my existence as I saw within a few minutes, on that occasion. Most of the Buzzards had evidently fed, and fed well, before I arrived on the scene, and contented themselves watching the voles, but one or two caught them while I watched, and the crows followed suit. Every vole on the hill-side had chosen that day and that hour to come out and afford the Buzzards the feast of their lives. I found a few dead voles, but as I was in a hurry I did not wait to examine them, to ascertain whether they had been killed by birds and left, or had died a natural death or of some disease.

I have also seen this species catching *cicadas* off the trunks of trees. I watched a bird on one occasion sitting on a branch, half way up a tree, looking at something above it. After a few seconds it flew straight up against the trunk, caught the *cicada* and flew off on to another tree to eat it.

The flight of all Buzzards is alike. Wings held usually in a line with the body, but occasionally back. Tail not much in evidence, and very often expanded like a fan. Wings long and rounded and nearly always fully extended, unless about to stoop or descend. Colouring apparently light, sometimes an almost transparent brown. A very light patch on each wing about two-thirds of the way from the body, like in the Large Indian Kite, but of course in the latter the tail is forked and much longer than in the Buzzards.

This Buzzard undoubtedly breeds all over the Himalayas, though I can find no record of its nest ever having been taken in this country. I cannot remember ever having seen the melanistic phase of plumage of this species, though it is so common with the other (*B. ferox*), though a dark brown phase of plumage is by no means rare, but not the dark chocolate brown, almost black, of *ferox.*

The nest and eggs are said to be similar to those of *B. ferox,* though I presume, a trifle smaller.

Genus PERNIS.

No. 1249. *Pernis cristatus.* The Crested Honey-Buzzard.

Characteristics. Size medium; bill weak and elongate; lores and sides of head covered with small scale like feathers, like forehead and chin, and unlike all other birds of prey.

Colouration. Very variable. Generally ashy grey from chin, and forehead to ear coverts, all round, *i.e.,* all the small scale like feathers. Thence passing into a grey brown or light brown on the neck and back.

The feathers frequently have very dark shaft-stripes. The whole upper surface of the bird, with wings extended, is brown or grey-brown and occasionally almost quite grey with a faint touch of brown only. Sometimes a bird may be seen with the whole of the head a very pale grey, but this is uncommon. Tail blackish-brown, with two bands, one much narrower than the other, greyish-brown. A narrow tip to tail feathers also greyish-brown, sometimes almost white.

The under surface is much lighter and is often irregularly spotted or banded with white. The lower surface of the wing when open is a very pale brown, almost white, with blackish bands. The tips of the primary quills black. A small crest of black feathers is usually present.

The plumage from the young to the adult varies a good deal, but the curious feeble bill and the small scale like feathers, instead of bristles, on the lores are enough in themselves to recognise this species by.

"Bill blackish, gape and base of lower mandible bluish; cere deep leaden colour; iris golden yellow, brownish-yellow or red; legs and feet yellow." (Blanford.)

Measurements. Length 25″ to 27″, though occasionally larger or smaller specimens may be found. Wing 15½″ to 17¼″; tail 10½″ to 12½″; tarsus 2″; expanse 4′ to 4¾.′

Habits, etc. This species is pretty well distributed all over the Punjab in suitable localities, but does not occur in the higher ranges of the Himalayas, and is not likely to be found much over 4 to 5 thousand feet above sea level. Found in most groves and gardens and along most of the canal banks and it breeds wherever it is found.

Not in the least shy, as a rule. On a tree it can be at once recognised by its comparatively small head, from any other bird of prey of the same size. The head almost invariably looks sleek, as though each feather had been plastered down, and its attention is usually attracted to the branches of trees on its own level and above and seldom on the ground, or over some adjoining plain, as is more often the case with most Raptores.

This species, in flight, rather resembles the *Spizaeti* and can seldom show itself in the open without having all the crows and mynahs in the neighbourhood shrieking at it and king-crows attacking it. Blanford says "its flight is direct and rather hurried than quick, and it seldom flies far, except when soaring." If disturbed from its perch, it simply hurls itself into space, flies low until it reaches the tree it intends to alight on, and then rises suddenly into the branches, rather like a Goshawk. The beats of the wings are quick and powerful. It soars well, usually in the spring and early summer, and is very noisy. The wings, when soaring, are held more or less on the same plane as is the body and not well back, as in the *Spizaeti*, and are somewhat longer and narrower than in that species. The bars on the wings and tail are very conspicuous as a rule.

It lives for the most part on the larvæ of wasps and bees and honey and is said to rob the eggs of small birds. I have never succeeded in bringing this species down to the net, although I have tried it frequently, with quails, sparrows, rats, snakes and even mole-crickets, although I know it occasionally kills lizards and on one occasion I disturbed one on the ground which flew off bearing a mynah in its claws. Since writing the above I have had one come down for a quail.

I remember reading a very interesting account of the doings of one of these birds, in captivity, many years ago. Unfortunately I cannot even now remember in what book or magazine I saw it, and was under the impression it appeared in the Journal of the B. N. H. Soc., but as I have been through practically every number since the early Nineties and can't find the account, I must be mistaken. The part that I particularly noted was a description of this bird flying off its master's hand in pursuit of something invisible to the man. He, however, followed in the direction as fast as he could, and discovered his bird attacking a huge bee-hive. The bees promptly swarmed round him, but did not appear to worry him much, and all the bird did was to ruffle his feathers and go on with his meal of honey or larvæ. Later on he got back the bird and, to his amazement, discovered that the bird had collected a considerable number between his feathers, which he continued to pull out occasionally and eat, for a couple of days after. His explanation was that the bird permitted the bees to get between the feathers, by raising them and then proceeded to keep them there by the simple method of smoothing them down again. The bees, between two feathers, were unable to back out and also unable to turn the thorax round to sting the bird. It sounds an amazing provision of nature, to keep the bird supplied with food, and it would be most interesting to know whether anybody else has noticed a similar proceeding on the part of this species.

The Honey-Buzzard builds in trees, from April to July, a nest of twigs lined with leaves or grass and lays one or two eggs, " broad oval in shape, white or buff thickly mottled and blotched with blood-red, reddish or yellowish-brown, and measuring about 2·03 by 1·72.

Genus Elanus.

No. 1232. *Elanus cœruleus*. The Black-Winged Kite.

Characteristics. Size small, length not exceeding 14″ ; tarsus very short, under 1½″.

Colouration. Upper parts ashy grey, the median and smaller wing coverts black, as also a narrow supercilium and the posterior lores ; primaries grey. Under parts including tail, the forehead and the sides of the head white. In many specimens the white on the neck and breast is tinged with light brown, and the back too is brownish grey. These are young birds, and the amount of brown varies, probably with age. Bill black ; cere, gape, legs and feet yellow ; claws black ; irides crimson, yellow in young birds.

Measurements. Length about 13″ ; tail 5″ ; wing 10½″ ; tarsus 1-3″ ; mid-toe without claw 1″ ; bill from gape 1·1″. (Blanford.)

Habits, etc. This pretty little Kite may be found all over the Province in suitable localities. Thin scrub jungles, cultivation or grassy slopes are its most favourite haunts. Not often to be found in dense jungles or open plains, and nor does it appear to ascend the Himalayas to any great height, though I have seen it at about 8,000 feet. The flight of this bird is unmistakable, the beat of the wing being slow and heavy for such a small bird. It is much given to hovering, but its method of remaining stationary in the air is, however, very different from that of the Kestrel.

It hovers with a regular slow beat of the wings, not the quick vibrations of the Kestrel. Then again, the wings are very often held straight, back, almost at right angles to the sides of the body and not horizontal to it as in the Kestrel, something like that of a " tumbler " pigeon as it prepares to " tumble."

On seeing an insect on the ground, the wings cease their beats and the bird, with its wings almost touching each other behind, descends very slowly at first, extending its legs as it approaches the ground and when within a few feet of it, the wings suddenly close into the body and the bird literally drops the last few feet.

Though they undoubtedly breed in the Punjab, I know of no record of their nest having been taken. Major Betham records having taken 3 nests near Poona (Journal of the Bombay Natural History Society, Vol. XIV., p. 397, and Vol. XV, page 710).

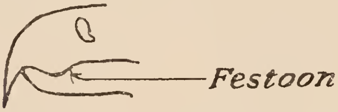
They appear to breed in the winter months, laying 3 or 4 eggs " usually densely blotched with brownish-red and measuring 1·53 by 1·21."

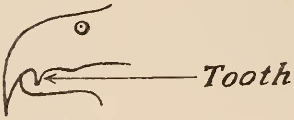
If they do breed in the Punjab, the season, I think, must be in the spring or summer, as during the winter they are not often to be met with in couples, whereas I have seen a pair together, on two or three occasions in May and June, in the Kangra District, not far from Palumpur, among the tea plantations.

Type G.

This chapter deals with a Type which comprises 9 genera of the Raptores, in all 14 species. The main characteristic of this Type is a tarsus feathered in front for *half its length or less* and naked behind ; *No prominent tooth on the cutting edge of the upper mandible.*

Before going further it may be as well to describe, for the novice, the difference between a " festoon " and a " tooth " as most birds of prey have either the one or the other. A " festoon " is a downward curving of the cutting edge of the upper mandible which is gradual and rounded, whereas a " tooth " is a sudden sharp pointed projection of the same, a little behind the point of the beak. The following rough diagram of each will make it clear :—





It must be remembered that some falcons have both, tooth and festoon, but the reader need not worry about the latter at all and it is only here mentioned so that there need be no confusion between them.

The next chapter will deal with birds which all have toothed mandibles, whereas none or those in the present Type are so adorned, but those in the next Type (*H*), resemble those in this Type (*G*), in having their tarsi similarly feathered, so it is very important to state here the factor which differentiates them, *viz* :—no tooth on cutting edge of upper mandible. For instance, if the examination of the legs shows that the tarsus is only feathered at the top, and for *less* than half its length, thus consigning the specimen to this Type, or the next, the only other point to look at is the beak. If toothed the bird belongs to the next Type, if merely festooned, then to this.

This Type deals not only with the largest number of species, but contains birds of all sizes from among the biggest to very nearly the smallest of the birds of prey, but one and all have their tarsi naked for more than half its length and no tooth on upper mandible.

The genera are all well defined and the species, with one or two exceptions, should give little, or no trouble to differentiate. Another feature all the species in this Type have in common is an eye of some shade of yellow, with the exception of one (*Butaslur teesa*) which has a white eye. This feature though must on no account be taken as a guide or key to the Type as it is apt to be very misleading as such, and is here merely mentioned as a feature on which no special reliance can be placed. The iris in Pallas's Fishing-Eagle (*Haliaetus leucoriphus*) is a yellowish brown, more yellow than brown in some and more brown than yellow in others, and in very old birds of other species, such as some of the true hawks, it becomes bright orange red. This feature merely helps with regard to the next Type (*H*) in which *all* the species have dark brown eyes, with no sign of any shade of yellow, but is of no importance in itself.

KEY TO THE GENERA IN TYPE G.

Genus.	Characteristics.
Circaetus (*one species*).	Size medium ; wing about 21″. Tarsus naked except at the upper extremity, clad with "small rounded or subhexagonal imbricate scales all round". Toes and claws short. No crest.
Spilornis (*one species*).	Size medium ; wing about 20″. Tarsus and claws very similar to *Circtus* ; Prominent broad nuchal crest. Colouring peculiar, being deep brown above and below with small white *ocelli* on under parts.
Butastur (*one species*).	Size small ; wing about 11″. Tarsi naked except at extreme top and covered with imbricate scales which are rather larger in front. The larger scales in front do not diminish in size to any appreciable degree from top until the base of middle toe is reached. Irides white in adults.
Haliaetus (*two species*).	Size large ; wing about 23″. Tarsi feathered in front for about one-third its length. Below the feathering a few large scutæ, *in front only*, the rest of the tarsus reticulated. Claws *grooved* beneath.
Polioaetus (*two species*).	Size medium ; wing about 17½ to 19″. Outer toe partially reversible. Tarsi feathered in front for about one-third of its length ; and clad both *in front and behind* with large coarse scutæ, reticulated on the sides. Claws *rounded* beneath, much curved and almost sub-equal.
Circus (*three species*).	Size medium. Wing varying from 13 to 16″. Build slight. Tarsus with transverse shields in front, which are largest near the top end and diminish in size gradually towards the base of middle toe, where they become absorbed in the reticulation. Irides yellow or yellowish brown, not white.
Astur (*two species*).	Size medium to small. Wing varying from 8½ to 14″. Tip of primaries in closed wing only reach to about half way down the tail. Tarsus scutellated behind and in front. Bill from gape two-thirds to $\frac{3}{4}$ of mid-toe without claw.
Accipiter (*two species*).	Size small in both species. Wing under 9″. Similar to *Astur* except that its tarsi are thinner and mid-toe longer, the latter being about twice the length (without claw) of the distance from bill to gape.

In all the above genera, except *Astur* and *Accipiter* no mention has been made of the distance that the tips of the primaries, in the closed wing, fall short of the end of the tail, as they comprise all comparatively "long winged species" in which the wing fall short of the tail by a matter of 2 to 3″ in some species, and reach to the end of the tail in others, so it would only be confusing to mention the fact in the keys, except in the case of the true hawks where the difference is very marked and the wing reaches to only about half way down the tail. These two *Astur* and *Accipiter*) can thus at once be separated from any members of the remaining 6 genera, of this Type. The very thin tarsi and long middle toe of *Accipiter* is enough to separate it from *Astur*, but it is not easy to define what constitutes a "thin" tarsus or "long" middle toe, unless there is something to compare with. For this reason the comparison is made between the length of middle toe as compared with the distance from bill to gape, in each genera.

The other six genera are very easily identified one from the other. *Circaetus*, *Spilornis*, *Haliaetus* and *Polioaetus* are represented by species of birds all as big and bigger than kites, so cannot be confused with Harriers or the White-eyed Buzzard-Eagle (*Circus* or *Butastur*) which are all smaller than any kite. From each other they can be identified thus:—

1. *Circaetus* ..	Tarsi naked except the upper extremity only.	1. No crest
2. *Spilornis* ..		2. Broad nuchal crest.
3. *Haliaetus* ..	Tarsi feathered for about one-third of its length.	3. Tarsi scutellate *in front* only; claws grooved beneath.
4. *Polioaëtus* ..		4. Tarsi scutellate in front *and* behind; claws rounded beneath.

The remaining two genera *Butastur* and *Circus* can be recognised from the preceding four, as already stated, by their smaller size, and from the true hawks by their longer wings, and from each other also by their size, as the wing of Butastur is about 11″ while that of the smallest Harrier would be about 13″. The Harriers can further be distinguished by a ruff of light coloured feathers which extend round the back of their heads from the throat, giving them rather an owl-like appearance. For further details there are the "keys" given above.

N.B.—I am rather diffident about placing *Haliaetus albicilla*, The White-tailed Sea-Eagle in this Type. According to Hume, the tarsus of a couple of specimens shot by him, were feathered, in front, for three-fifths to five-eights of their total length, whereas Blanford makes no such exception in the case of this species. Unfortunately I have only handled one specimen and did not notice its tarsi.

KEY TO THE SPECIES.

Circaetus gallicus.	As for genus.
Spilornis cheela.	As for genus.
Butastur teesa.	As for genus.
Haliaëtus leucoryphus.	Wing about 23, usually under 24″. Tail with a broad white band in the centre, in the adult plumage, rounded, the outer tail feathers being about 1 inch shorter than the two middle ones.
Haliaëtus albicilla.	Larger, wing about 25 to 26″. Tail, except at the base, all white, wedge shaped, the outer rectrices being about 2 inches shorter than the middle ones.

Polioaëtus ichthyaœtus.	Basal three-fourths of *all* tail feathers white in adults, mottled in young.
Polioaëtus humilis.	*Middle* tail feathers brown throughut.
Circus macrurus.	Wing about 14½″, outer web of 2nd, 3rd, 4th, *not* 5th, quill notched ; Tarsi over 2½″ but under 3″ in length.
Circus cyaneus.	Wing about 15″, outer web of 5th, quill also notched ; Tarsi about 3″.
Circus æruginosus.	Larger, wing about 16″ ; tarsus 3½″.
Astur palumbarius.	Larger, wing 12″ to 15″ ; tarsus over 3″.
Astur badius.	Small, wing 7 to 9″ ; tarsus 2″ or under.
Accipiter nisus.	No gular stripe ; 5 or 6 dark bars, one terminal on 4th quill, in adults (Blanford).
Accipiter virgatus.	Generally a dark gular stripe ; 7 or 8 bars on 4th quill in adults (Blantord).

FAMILY FALCONIDÆ.

SUB-FAMILY FALCONINÆ.

Genus CIRCAËTUS.

No 1216. *Circaëtus gallicus.* The short-toed Eagle.

Characteristices. Size medium ; wing about 21″. Tarsus naked except the upper extremity, clad with " small rounded or hexagonal imbricate scales all round." Toes and claws short; inner and outer toes, without claws, sub-equal, as also are the claws, which are not very curved.

Colouration. "Upper parts generally brown, Shafts on head, back and wing-coverts blackish ; longer scapulars, primary and some secondary quills blackish brown outside, the quills white inside except at the tip and the primaries for some distance up each border ; all quills except first primaries with dark cross-bands ; tail brown above white-tipped, whitish below, with dark cross-bands, generally four in number, the first concealed by the coverts ; the inner webs were all rectrices except the middle pair partly white. (Blanford.)

The upper portion of the breast is pale brown with dark shaft stripes and gets lighter lower down, the abdomen and tail coverts being white, with dark brown spots. The young plumage is somewhat lighter on the upper parts and white below with "brown shaft-stripes on chin, throat and upper breast and a few scattered spots of light brown or rufous on the lower breast and abdomen."

" Bill pale greyish blue, tip blackish ; cere whitish ; irides bright orange yellow ; legs and feet pale earthy greyish brown. "

Dimensions. " Length 26″ to 28″ ; tail 11·5 to 13″ ; wing 21 to 22 tarsus 3·75 " (Blanford.)

Habits, etc. This Eagle, by no means common, except in certain localities, is almost unmistakable either a 1,000 ft. up in the air, or seated on a tree. In the air it appears to be silvery grey throughout, when seen from below, and very much larger than his measurements would lead one to believe.

Blanford likens it to a Harrier—"but more frequently circling in the air or beating over the ground and bushes like a Harrier"—but this is a bit misleading so far as the flight is concerned, as a Harrier's mode of progression is a succession of flaps followed by a bout of sailing whereas the Short-toed Eagle is seldom seen to flap. On the open plains where it is most frequently met with, it will be found to circle and hover, circle and hover, changing its position frequently to search different bits of the plain. On seeing its prey it will sometimes stoop with closed wings at a tremendous pace, until within 50 ft. or so of the ground and thereafter will descend gently to the ground, rather like a Black-winged Kite, only I have never seen it do so with legs extended or wings held so far back as that of the latter. Its flight is generally light and graceful, and the wings are sometimes held well back, when soaring, but not always.

Seen flying and at very close quarters a narrow dark line is discernible in the region of the first primary, and some dark marking on either side of the chin. Closer still, and the spots on the abdomen may also be noticed, but usually what one sees is a great big bird of a uniform pale silvery grey throughout. Seated on a tree, some distance away, the first thing to strike the observer is a huge head, more like an owl's than an eagle's. I have seen this bird tackle and kill a large snake which, I think, was a *Zamenis* and quite 5 to 6 ft. in length.

I saw the bird dropping from a great height, on the canal bank near Gurdaspur, then, as usual, steady himself before he got near the ground and finally sit on the bank whence he rushed at the snake, with outspread wings. I could not see where he caught it, but he flew off the instant he had got a good grip and judging from the very small amount of snake, and that about the centre of its body, I concluded that the bird had its head in its claws and the rest of the snake was coiling round the bird. I have twice caught this species in nooses, with a rat as a bait. On one occasion the eagle sat down about 4 ft. from the nooses and then rushed at the rat through them and was caught, and on the second it came down direct, but very slowly and almost vertically downwards, so that it got the rat without touching the nooses, and only got caught by the merest chance as it was flying away with it.

I have seen this species on the bare slopes above Dharmsala, at about 7,500 ft. though he is by no means a familiar feature of the hills, at these altitudes.

The wings, in flight, appear long and rounded and the tail ample, and extended well beyond the line of the wings.

It is said to breed usually in trees and build a "loosely constructed nest of sticks, sometimes lined with grass or green leaves", laying a single egg, a broad oval, bluish white without spots and measuring 2·9 by 2·3.

The food of this species consists, for the most part, of lizards, snakes, frogs, rats and insects. I have tried to catch it with a bird (a quail) for a bait, but in vain.

Genus SPILORNIS.

No. 1217. *Spilornis cheela.* The Crested Serpent-Eagle.

Characteristics. Size medium; wing about 20″. Tarsus naked, except at the upper extremity, clad with small rounded or subhexagonal imbricate scales all round; toes and claws short. *Prominent broad nuchal crest.*

Colouration. Deep chocolate brown both above and below, parts of the head, crest, wing-coverts and primaries black or blackish. The upper parts have a deep purplish gloss. The under surface, together with the smaller wing-coverts with small white *ocelli* and frequently many of the back feathers, tail-coverts, scapulars and secondary quills are tipped with white. The crest, when erected, shows a considerable amount of white, or when seen from behind, the feathers having white bases.

The upper parts are darker than the under parts, and in the open wings, and tail, two or more broad white or whitish bars are visible from below.

"Bill plumbeous, bluish black at tip and on culmen; cere, skin of lores, and gape bright, or in some dingy lemon-yellow; irides intense yellow; legs and feet pale dingy yellow." (Blanford.)

Measurements. Length about 29″; wing 20; tail 13; tarsus 4.

Habits, etc. Blanford states that "this Eagle is usually found on trees near water, especially the fine trees along the irrigation-channels and canals in Upper India, and along stream beds in the Lower Himalayas."

I cannot ever remember having seen this species actually on the plains of India though it is fairly common all along the lower hills and up to an elevation of about 6,000 ft., and may even be found soaring at still higher elevations. Since writing the above I have come across one on the canal bank near Gurdaspur. Usually to be met with on the banks of streams and the edges of rice fields; as often sitting on a boulder as in a tree. It lives chiefly on frogs, snakes, lizards, crustacea and insects. Mr. Hume quotes Mr. Thompson as saying that "the parent birds often succeed in destroying pheasants and bringing them to the nest," and Capt. Hutton goes still further and says "where a pair take up their quarters, no fowl or pigeon can escape; I have had dove cot cleaned out over and over again by them."

Personally I cannot say I have ever known these birds to make even an attempt to chase a bird of any sort, except when the latter was in difficulties.

I have succeeded in catching a good many at various times and have had a few come down to small birds but invariably after a long wait, as if making sure that the bait was really in difficulties and could not get away, but more often I have had to change the bait (a bird) and put down a rat or a small snake.

The claws of this species are nearly always covered with mud showing that he grabs the most of his food from wet paddy fields and jheels.

This bird breeds on trees at elevations varying from about 2 to 4,000 ft., as a rule, during the spring, making a nest of sticks lined with green leaves, and lays usually only one egg, streaked and spotted with brownish red and purple and measuring about 2·78 by 2·2. (Blanford.)

The flight is very Hawk-Eagle like. Wings held very far back, more so, I think, than any other bird of prey. The wings appear very broad and rounded and the tail is seldom spread out when soaring, and usually appears very narrow.

The dark ground colour and the light broad bars on wing and tail are unmistakable at almost any height. During the breeding season and when the young birds leave the nest, this species is much given to soaring and at these times is particularly noisy.

The call is a peculiar four-note whistle, the first three notes being short and last long, something like "ti ti ti tiiiu," and oft repeated at short intervals.

The Crested Serpent-Eagle is generally to be found soaring high over trees and very often dense forests and seldom over barren hill-sides, unlike his cousin the Short-toed Eagle which is seldom found near thick jungle and almost invariably over sandy plains or barren hill-sides.

Genus BUTASTUR.

No. 1220. *Butastur teesa.* The White-eyed Buzzard Eagle.

Characteristics. Size small, about that of a crow, wing about 11″. Tarsi naked except at the extreme top, and covered with imbricate scales which are rather larger in front. The larger scales, in front, do not diminish in size to any appreciable degree from the top until the base of the middle toe is reached. Irides white in adults, brown in young birds.

Colouration. There is not much variation, in this species in colour generally, although the head and neck in individuals may vary from brown to almost white with dark shaft stripes.

General colour, throughout, brown frequently with a rufescent tinge on the upper parts the feathers more or less dark shafted. There is always a very light buff or white nuchal patch, made by the bases of the feathers showing through which is usually very conspicuous, and there is also a light patch on the upper portion of each wing, which is also conspicuous both when flying and sitting. Quills brown above and whitish beneath, pure white near their bases.

Chin and throat white with three dark brown stripes, one on either side and one in the centre of the chin.

"Cere, gape and base of lower mandible orange terminal portion of both mandibles black; irides pale yellowish-white in adults, brown in young birds. Legs and feet dingy orange yellow." (Blanford). *N.B.*—Punjab birds have, as often as not, absolutely pure white eyes with no sign of any yellow.

Measurements. "Length about 17 ; tail 7 ; wing 11·5 ; tarsus 2·3 ; mid toe without claw 1·3 ; bill from gape 1·3." (Blanford.)

Habits, etc. This is a very common bird in the Province and to be found commonly perched on telegraph wires along the railway line, or on the tops of trees or bushes, and frequently on the ground, in any fairly open country. Not to be found in thick jungle or high up in the Himalayas, though I have seen this species as far into the mountain ranges as Kulu, but at altitudes not exceeding 5,000 feet.

In the spring and early summer this is a very talkative bird and its not unmusical and somewhat plaintive call may be frequently heard, as the bird soars. It soars well and during the beginning of the breeding season is often to be seen high up, as often as not with bigger birds of prey.

In flight it somewhat resembles a sparrow-hawk but the wings are longer than the latter and the tail does not project so much as in the hawk.

Seen from below, the colouring is a light silvery grey on the wings, the body being a little darker. The wings are held on the same plane as the body and appear narrower and longer than that of any of the Hawks, and not so pointed and shorter than that of any of the Falcons.

It lives for the most part on insects, lizards, mice and frogs, but will attack a bird in difficulties, or wounded, with great dash and is a very easily caught species, in a net, in consequence.

I had a curious experience with this species on one occasion. I had set a net, with a pigeon for a bait, for a Booted Eagle, which had already fed and was not at all keen on coming down. After waiting about ten minutes I was on the point of giving him up and picking up my net and had actually moved out of my hiding place when a Mottled Wood-Owl (*Syrnium ocellatum*) flew into the net after the pigeon and while I ran forward to catch the owl, a White-eyed Buzzard Eagle came from the opposite side, flew over the pigeon and fiercely attacked the owl, when I was only a few feet from it, so I was able to secure both. The Wood-Owl is, in my experience, one of the most difficult birds to catch in a net. It will either sit on its perch and blink away without attempting to come down at all, specially in the day, or it will come readily and turn aside when within a couple of feet of the net, and the back-ground must be such as to make the net absolutely invisible before one of these owls can be caught. Why this one came down, in broad day-light, and did not swerve as they usually do, I do not know, and why the Buzzard should ignore the pigeon and attack something larger than himself was also curious, especially as it was in the depths of winter and therefore neither eggs nor youngsters were to be protected.

This species is much given to not only sitting on the ground but does a great deal of walking and running about, in quest of insects.

It builds on trees, from March to May, a nest made of sticks, usually unlined, and lays 3 to 4 eggs, usually white but sometimes spotted, measuring 1·83 by 1·53.

Genus HALIAËTUS.

No. 1223. *Haliaëtus leucoryphus.* Pallas's Fishing-Eagle.

Characteristics. Size large, wing about 23″. Tarsi feathered in front for about one-third of its length, with a few large scutæ below the feathering, in front only. The remainder of the tarsus reticulated. Claws grooved beneath. Tail rounded, a white band across the centre.

Colouration. The whole and head and neck light coloured, varying from pure white on the forehead, whitish on the throat, sides of neck and head and chin, to fulvous. The body above and below dark brown, often with a purplish gloss. The tail has a wide band about four inches in width, across it, and some three inches from the end, which is pure white.

The young plumage is totally different being a pale brown throughout, darker on the back than on the lower surface. Quills and tail-feathers dark brown. In this phase of plumage the bird somewhat resembles the lineated phase of the Imperial Eagle, but, of course, cannot be confused with it as its tarsi are not feathered, back and front to the toes, as in the *Aquila*.

"Bill dark plumbeous, cere and gape light plumbeous (irides greyish yellow; legs and feet dull white; claws black." (Oates.)

N.B.—In many Punjab birds I have found the eye some shade of brownish yellow or almost entirely light brown.

Measurements. "Length of a female 33; tail 12; wing 23; tarsus 4; bill from gape 2·9; males are smaller, the wing being 1 to 2 inches shorter." (Blanford.)

Habits, etc.

This fine bird is common on all our Punjab Rivers and is frequently met with on large jheels and tanks, on the plains of N. India. Its rancous call, resembling ungreased cart wheels, can be heard for very long distances and not a few legends are woven round this species in the lower hills.

Fishermen, to whom this species is very familiar, in some parts of the country, firmly believe that the species gives birth to two absolutely separate species of birds. The light coloured youngsters remain light coloured all their lives, and turn into the Steppe Eagle (*Bugga Ookhab*) while the dark ones take after their parents!

Fishermen, as a class, are fairly observant and yet strangely enough they do not appear to have observed the fact that the young of Pallas's Fishing Eagle are always light coloured, so the species should very soon die out.

In parts of the Kangra District the "Kurl and Kurli" are responsible for the distribution of the rain. The nest, which nobody has ever seen, is placed on a very high cotton tree and if it rains when the "Kurli" is sitting on her eggs, it is not likely to stop for weeks, whereas if the "Kurl" is sitting when the rain begins, it means light rain and fine weather to follow. "*Kurli bursta*" is a household word in the district.

This latter is a curious legend in the district for the simple reason that the "*Kurl*" is by no means a common bird except where the River debouches on to the plains in the extreme end of the district.

That the nest is placed on a high cotton tree is very often correct, but though it may never have been seen by the Kangra man, every fisherman in the lower reaches of the river is very familiar with it. Most Kangra men are very uncertain as to whether the Kurl and Kurli are Pallas's Fishing Eagle or the Osprey, and both birds have been pointed out to me as "Kurl".

This is a very powerful bird and does not hesitate to attack and rob any of the true Eagles for tit bits, except the Golden, which, of course, it probably never meets. I have seen as many as five at one time following in the wake of fishermen, as they hauled their nets through the river. They sit about on convenient trees, or even on the ground and wait for the haul to be brought to the bank, and are off with any fish that happens to be left a little away from the men.

This Eagle will not go under water after its prey, like the Osprey, but it will take one within six inches or so below the surface and Mr. Hume records taking a fish from one of these Eagles, weighing 13 lbs. 2 ozs. which the bird had succeeded in carrying right across the river.

I have seen this species make a determined swoop into a flock of duck as it flew past but he did not attempt to follow up. It is not often that they attack unhurt birds but a wounded duck or goose stands a poor chance of escaping from one of these.

Pallas's Fishing Eagle is not proud and will descend to robbing a tern of a tiny fish not more than 4 to 5 inches in length, or a Marsh Harrier of its hard earned frog. It will unhesitatingly attack even the Imperial Eagle and being faster on the wing than any of the members of the genus *Aquila*, except *chrysætus* has no difficulty in robbing them of their prey, though I, on one occasion, witnessed a most interesting spectacle in which a fine female Imperial Eagle devoured a mynah. The bird had been originally caught by a Laggar Falcon which had to give it up to a Tawny. The Fishing Eagle attacked the Tawny and both came to the ground with the mynah between each of their claws and while other Eagles circled round, ready to join in the fray, the Imperial came straight down and at once attacked and got the mynah. The Tawny at once released its hold but the Fisherman held on for a little time, before giving up, but did not move away as the other had done and only waited for an opening to attack the Imperial.

Mr. Hume says that he has never known this bird to protect its nest while eggs were in it, but once the young arrived on the scene, it was very different, and the pair attacked any man who went for the nest.

They breed in the late autumn and early winter, building a huge nest of sticks in the fork of a tree and lay from two to four eggs, "greyish white, unspotted; very dark green when looked through against a light, and about 2·77 by 2·17."

The flight, when beating up or down a river is hurried and the wing usually slightly bent back from the "wrist." It soars well and attains tremendous heights. The wings are held in the same plane as the body and the tips of the primaries very frequently appear to be hanging downwards, *i.e.*, below the plane of the body. The tail is seldom spread out and frequently appears to be very narrow.

No. 1225. *Haliaëtus albicilla.* The White-tailed Sea-Eagle.

Characteristics. Size large, wing about 26 inches; tail white except at the base (no marginal dark band at the end, as in *leucoryphus*) and *wedge-shaped.*

Colouration. Very similar to *leucoryphus* except that there is a vast difference in the tail. Whereas of *leucoryphus* it may be said that the tail is dark with a broad white band in the centre, in the case of this species it is all white, except at the extreme base.

"Cere and bill yellow in adults; cere yellowish brown, bill black in young birds; iris yellow (brown in the young); feet yellow. There is a slight ruff of lanceolate feathers, far less distinct than in *leucoryphus*, and the end of the tail is wedge-shaped, the middle feathers being considerably longer than the outer." (Blanford.)

In the young the tail feathers are "white more or less mottled and edged with brown."

Measurements. Female.—"length 34; tail 13; wing 26; tarsus 4½; bill from gape 3. Males are rather less, wing 24·5."

Habits, etc. This is a winter visitor to India and by no means common. I have seen the bird on two or three occasions on the Chenab River, near Riasi, in Kashmir State, and shot the only one I have ever had in my hand in Bhadarwar, in November of 1898.

One huge bird which I took to be this species I saw flying up the Beas River in Kulu, in April 1916. Unfortunately I only got a glimpse as it passed between some trees, but in that glimpse I noticed the great deal of white about the tail, which, together with the very dark colouring of the rest of the bird and its immense size, made me feel pretty sure that it *was* this species.

As already stated I am rather diffident in placing this species in Type G. as Mr. Hume says that the feathering of the tarsus in the two specimens he shot extended to from five-eighths to three-fifths of its length, but Blanford makes no mention of this.

It cannot, however, be mistaken for any other species. From the true Eagles, which it resembles in size, it can be differentiated by its tarsi which are *not* feathered to the toes, back and front, and from *H. leucoryphus* by the shape and the amount of white on the tail.

It appears to resemble the preceding species in its habits generally and nothing appears to be known of its nidification in this country.

Genus Polioaëtus.

No. 1226. *Polioaëtus ichthyætus.* The Large Grey-headed Fishing-Eagle.

Characteristics. Size medium, wing about 20". Tarsi feathered for about one-third of its length, scutellated behind and in front, reticullated on the sides. Claws rounded beneath. Basal three-fourths of *all* tail feathers white in adults and mottled in the young, *including* the two central feathers, terminal 2 to 3 inches dark brown.

Colouration. Head and neck all round grey, the crown and nape being light brown. The grey feathers often with whitish shaft stripes. Quills very dark brown, almost black; wing-coverts, back, rump and upper tail-coverts dark brown, as also the terminal band on the tail; Upper back a little paler and breast a little paler still. Abdomen, flanks and basal three-fourths of tail pure white.

"Young birds are light brown, with pale edges to the feathers, those of the head, neck, upper back, and lower parts with whitish shaft stripes. The quills are barred and the basal portion of the tail mottled brown and white." (Blanford.)

"Bill dark brown, basal two-thirds of lower mandible bright plumbeous; cere and iris brown; legs and feet china white; claws black. (Oates.) Iris clear yellow, sometimes tinged with reddish and mottled with brown." (Legge.)

Measurements. "Length about 29; tail 11; wing 19; tarsus 3·7; bill from gape 2. Males rather smaller."

Habits, etc. These Fishing Eagles are recorded in the Fauna of British India as being found "throughout the greater part of the Peninsula of India in suitable localities, from the base of the Himalayas, but not west of Delhi, nor in Sind, and rare to the southward . . . . . ." I cannot remember ever having got one in the Punjab nor can I find any record of one having been so found in the B. N. H. Society's Journal.

Every specimen I have, so far, shot or captured, has turned out to be the next species, *viz.*, *P. humilis*, but as there is no reason why they should not occur in the Province, I have included the species, provisionally, and described it in the event of one being met with.

Their habits and eggs seem to be very similar to the next species, but though the bird is bigger than *P. humilis* it appears to lay a smaller egg.

No. 1227. *Polioaëtus humilis.* Hodgson's Fishing-Eagle.

Characteristics. Size medium, wing about 18; Tarsi feathered for about one-third of its length, scutellate behind and in front and reticullated on the sides. Claws rounded beneath. *Middle-tail feathers brown throughout*, the remainder, for the basal three-fourths, mottled, terminal 2 to 3 inches dark brown.

Colouration. Head and neck all round ashy grey, browner on the nape and crown. Sometimes a few brown feathers scattered about all over the head.

Upper parts generally dark brown, quills blackish. Breast ashy brown, darker in some specimens than in others. Abdomen, flanks and under tail-coverts white. The two middle rectrices brown throughout but the remaining tail feathers mottled white and brown for about $\frac{3}{4}$ of their length, and dark brown for the terminal fourth, with a thin margin of white or buff to the tips. Under parts of tail lighter than the upper.

"Young birds are paler brown; they want the grey on the head, and the breast feathers have white shafts and ends." (Blanford.)

"Upper mandible blue-black; cere, gape and lower mandible leaden blue; irides bright yellow; legs and feet white, washed with leaden blue; claws black." (A. Anderson.)

Measurements.

"Length of a Himalayan female 24·5; tail 9·2; wing 17·5; tarsus 3·1; bill from gape 1·7. Males very little smaller. Specimens from Assam and Cachar have generally a wing of 16 to 17 inches; Malay birds are much smaller." (Blanford.) The following are the dimensions of a very fine Himalayan female procured by me on 7th July 1919 in Kulu:—Length 25; wing 18·5; tail 9·5; tarsus 3·2.

Habits, etc.

This Fishing-Eagle is found throughout the Province from Kashmir to the Jumna River, in suitable localities. Large streams with wooded banks are his favourite haunts, but I have met him on open stretches of river with hardly ten trees within a mile of country.

Like his cousin, Pallas's Fishing-Eagle, he advertises the whereabouts of his nest to all and sundry, by making an appalling noise in its immediate vicinity. If one happens to be sitting in the nest, it welcomes the advent ef the other by a succession of querulous shouts and cackles, not unlike a very small child crying. In the distance the sound is distinctly plaintive and childlike but at close quarters it is querulous and unpleasant. The Fishing-Eagles are not given to soaring and a hurried rush, with fast beating wings, up and down a stream, from one lot of trees to another seems the limit of his movements, at any one time. The species is unmistakable at any stage by the curious light, if not white, colouring fore and aft and the deep brown in between.

The Fishing-Eagle will sit for hours on a branch overlooking a pool in a stream and drop like a stone on to any fish that has the temerity to show itself near the surface.

I have never seen this species disappear under water, like an Osprey, after fish, and nor have I ever seen it strike the water otherwise than legs first, but on the other hand I have seen it almost dragged under by, presumably, a fish too big for the Eagle to bring to the surface. The Eagle struck the water with terrific force, its legs going in almost up to the body, and there it remained for a few seconds, its wings working hard to rise. Finally, when it did rise, its claws were empty, but both, body and wings, had been repeatedly wetted, without in any way interfering with its flight when it did eventually give up the struggle.

This species is fairly common all over the Kulu Valley, and they must do a good deal of damage among the trout, but on the other hand, before one can recommend its extermination, it is as well to thoroughly investigate its life history and see what it can show on the other side of its Ledger in the way of keeping down other enemies of the trout, which, but for the Eagle, might prove to be a bigger danger to the fisheries than the Eagle.

The Hodgson's Fishing Eagle builds in trees on the banks of the streams which it frequents, a large nest of sticks, from January to May, and lays two to three eggs, white and unspotted and measuring, according to Blanford, 2·75 by 2·12.

The claws of this species are very curved and much of a size, the hind claw not being much bigger than the outer claw.

Rather an ungainly looking bird, either sitting or flying, except for the head, with its bright yellow eye, which is very nice looking, but the body, in repose, has rather the look of a Vulture being somewhat hunch-backed.

This species may be found as high up as 8,000 ft. but its favourite elevation is between 3,500 and 5,000 ft., and it is by no means rare even on the plains.

(*To be continued.*)

NOTES ON INDIAN BUTTERFLIES.

(*Continued from Vol. XXIII., Page* 310.)

BY

LT.-COL. W. H. EVANS, F.Z.S., F.E.S.

Since my last paper on Indian butterflies appeared in the Journal, a period of 4½ years has elapsed. Before returning to India, however, I was able to spend some time at the British Museum and an effort is made here to bring up to date our information on Indian butterflies.

18. Fruhstorfer has made some progress with the Indo-Australian section of the Macrolepidoptera of the World and up to page 824 in the German edition has been received at the British Museum.

(1). *Euripus halitherses, Db & Hew,* in addition to the already described female forms, there are given,

gulussa, Fruh, an extreme dry season form with a nearly white hindwing.
neda, Fruh, with large white submarginal spots.
pademoides, Fruh, as plate 204. 1 and 1a. Lep Ind.
gyrtona, Fruh, as *nyctelius* but missing the 3 streaks in the basal zone of the hindwing.

Thus with *isa, haliartus, alcathæoides, cinnamoneus,* and *nyctelius*, 9 forms of females are now described. As 2 forms of females are rarely obtained alike, opportunities exist for making lots more new names.

The race flying from Tenasserim to Indo-China, said to be larger and darker, is called *mastor, Fruh.*

(2). *Euripus consimilis, Wd.* Three races; *consimilis,* N. India Upper Burma; *meridionalis, WM,* South India; *eurimus, Fruh,* Lower Burma Here again the female is given many names:

White abdomens dorsally black ringed,
  amala, Fruh, yellowish as *Parhestina mena.*
  sunta, Fruh, white and milky blue.
  diocletiana, Fruh, as the *Euplœa* with the same name.
Abdomens entirely black,
  gudila, Fruh, ground colour “black blue.”
  triquilla, Fruh, ground colour “blue black,” with the spots on the hindwing practically obsolete.

(3). *Eribœa athamas, Drury,* is the N. Indian and Burmese race with varieties *hamasta, M,* and *bharata, M.* Other races are *agrarius, Swin,* South India; *madeus, R & J,* Ceylon: *andamanicus, Fruh,* Andamans.

(4). *Eribœa arja, Fd.* The large, extreme wet season form is *rœberi, Fruh,* and the extreme dry season form *vernus, R & J.*

(5). Of *Eribœa moori, Dist,* from the Malay Peninsula, *sandakanus, Fruh,* is the race found in Indian limits, Assam and Burma: the small wet season form is *marginalis, R & J.*

(6). Of *Eribœa jalysus Fd,* from Sumatra, the Burmese race is *ephebus, Fruh.*

(7). The smaller Tenasserim race of *Eribœa eudamippus, Db,* is separated as *jamblichus, Fruh.*

(8). The race of *Eribœa schreiberi, God,* from S. Burma and the Malay States is called *tisamenus, Fruh.*

(9). The Ceylon race of *Charaxas fabius, Fab,* is called *cerynthus, Fruh.*

(10). *Charaxas polyxena, Cr.* The typical form is Chinese: the W. Himalayan race is *hemana, M:* the small Sikkim race is *hindia, But:* the Assam race *hierax, Fd:* the Burmese race *agna, M.* In addition to the numerous named varieties, Fruhstorfer calls the form with the underside red brown, showing the white band from the upperside by yellowish indications, *rossa, Fruh.*

(11). *Pareba vesta, Fab.* W. Himalayan race *anomala, Koll*: the typical form from Sikkim, Assam and China: the Burmese form *sordica, Fruh.*

(12). *Libythea rohini, Mar*, is placed as a race of *narina, God.*

(13). *Libythea lepita, M*, is treated as a separate species to *celtis Fuess*, which, as far as India is concerned, is only found in Chitral.

(14). The South Indian race of *Libythea myrrha, Gray*, is separated as *carma, Fruh: rama, M*, being retained for the Ceylon race.

(15). *Libythea hauxwelli, M*, is said to be the extreme dry season form of *geoffroyi alompra, M.*

(16). The Indian races of *Zemeros flegyas*, Cr, (typical form chinese) are: *indicus, Fruh*, Sikkim and Assam: *allica, Fab*, a pale race Karen hills, We are not told what to call the Tenasserim and W. Himalayan forms.

(17). The W. Himalayan race of *Dodona, dipœa, Hew*, is *nostia, Fruh: dracon, Den*, is said to replace *dipœa*, in Upper Burma.

In the " Entomologische Rundschau " No. 29, p. 23 (1913), Fruhstorfer confines *Dodona eugenes, Bates*, to the Eastern Himalayas and calls the W. Himalayan race *venox*.

(18). The race of *Dodona adonira, Hew*, from the Ruby Mines, Upper Burma, and possibly the Naga hills is called *argentea, Fruh.*

(19). The Eastern form. *Dodona ouida, M*, flying from Nepal to Assam, is called *phlegra, Fruh.*

(20). It is stated that *Dodona binghami, M.* and *angela Grs*, probably refer to opposite sexes of the same species.

(21). *Dodona longicaudata, DeN*, is given as the Northern race of *deodata, Hew.*

(22). *Taxila burnii, Den*, is said to be an *Abisara* and not a *Taxila.*

(23). The dry season form of *Abisara fylla, Db*, is called *fyllaria, Fruh.* The Upper Burmese race has not been named, but will probably prove to be intermediate between *fylloides, M*, from Central China and *magdala, Fruh*, from Tonkin.

(24). The Indian forms of *Abisara echerius, Stoll*, (chinese) are treated thus: race *fraterna, M*, Mussoorie to Kanara: race *prunosa, M*, Ceylon: race *bifasciata, M*, Andamans and Nicobars: race *angulata, M*, (based on a dry season male), the Eastern Himalayas and presumably Burma. *Abnormis, M*, is a variety of *angulata*: *jhana, Fruh*, is a female variety from the Chin Hills with 3 white bands on the forewing; *suffusa, M*, is a dry season form of *fraterna*, described from Bombay.

(25). The Burmese race of the Malayan Abisara *kausambi Fd*, is called *paionea, Fruh.*

(26). *Abisara neophron, Hew*, is divided into races thus: *neophronides, Fruh*, Sikkim and Nepal: *neophron, Hew*, Assam and Naga hills: *gratius, Fruh*, Toungoo to Tonkin: *chelina, Fruh*, Tavoy, South China and Perak.

(27). The Burmese race of the Sumatran *Taxila thuisto, Hew*, is called *sawaja, Fruh.* (28).

(28). In the *Loganias, massalia, Doh*, and *marmorata, M*, are placed as separate species: *watsoniana, DeN*, is put as a race of the latter from the Karen hills.

(29). The Burmese race of the Javan *Allotinus subviolaceus, Fd*, is called *manychus, Fruh.*

(30). *Allotinus nivalis, Druce*, is confined to Borneo and the Burmese race is called *substrigosa, M.*

(31). A new *Allotinus* is given from Burma-*posidion atacinus, Fruh : posidion* is described by Fruhstorfer from Java. It is said to be a common form, hitherto unrecognised. *Posidion* differs from *horsfieldii, M,* in having a shorter male brand and less striping below : it differs from the closely allied *unicolor, Fd,* from Penang, which is the only *Allotinus* with rounded wings. *Posidion* is figured by De Niceville in his "Butterflies of India," etc., on plate 26, fig. 156, and by Swinhœ "Lep Ind" pl. 616·3 and 3B.

(32). The Burmese form of the Javan *Allotinus horsfieldii, M,* is called *continentalis, Fruh.*

(33). The Burmese race of the N. Bornean *Allotinus fabius, Dist.* is *panormis. El,* the female of which is figured in "Lep Ind" pl. 616, fig. 3a and 3c, while the male figured in 3 and 3b is *posidion atacinus, Fruh.*

(34). *Allotinus apthonius, Fruh,* is a new species, which appears to have been caught by Fruhstorfer himself at Tandong Tenasserim. The male is similar to the male of *drumila, M,* the apex of the forewing being less sharp and the ground colour above a lighter richer, brown : the median-band is more bent forward : the underside is greyish yellow and the anteterminal band is absent. The female is midway between the females of *drumila, M,* and *multistrigatus, Den.* The new form was caught in May in the dry season at an elevation of 4,000 feet.

(35). The Indo-Burmese race of the Javan *Gerydus boisduvali, M,* is called *miletus, Fruh. Gerydus longeana* is treated as a separate species.

(36). *Gerydus biggsii, Dist.* Two varieties are described : *atomaria. Fruh,* with the ordinary white band shaded greyish brown : *denticulata, Fruh,* is a female with dentate wings.

(37). The Burmese race of the Javan *Gerydus symethus, Cr,* is called *diopeithes, Fruh.*

DESCRIPTION OF A NEW SNAKE OF THE GENUS *CONTIA*, B. & G., FROM PERSIA.

BY G. A. BOULENGER.

CONTIA CONDONI, sp. n.

Rostral broader than deep, the portion visible from above measuring about one-third its distance from the frontal; suture between the internasals a little shorter than that between the prfærontals; frontal one and a half to one and two thirds as long as broad, not much broader than the supraocular, as long as its distance from the end of the snout, shorter than the parietals; nasal undivided; loreal small, as long as deep; one præocular; two postoculars; temporals 1 + 2; seven upper labials, third and fourth entering the eye; four lower labials in contact with the anterior chin-shields, which are longer than the posterior; chin-shields, of both pairs in contact with each other. Scales smooth, in 17 rows. Ventrals 169-173; anal divided; subcaudals 69-75. Pale brown above, with small blackish spots, forming narrow crossbars, continuous or interrupted and alternating on the back; white beneath.

Total length 520 mm.; tail 145.

Two specimens, male (V. 169; C. 75) and female (V. 173; C 69), from Shiraz, presented by Lt.-Col. deV. Condon to the Bombay Natural History Society's Museum. The male is now in British Museum.*

This species is allied to *Contia fasciata*, Jan, and *C. brevicauda* Nikolsky, both of which are known from Persia. The scale formula alone enables one to distinguish the three snakes :—

C. condoni.	Sc. 17;	V. 169-173;	C. 69-75.
C. fasciata.	,, 15;	,, 158-171;	,, 48-62.
C. brevicauda.	,, 15;	,, 158-168;	,, 38-41.

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* The specimens have been killed in a very rough manner and are, therefore, unfortunately, in an unsatisfactory condition.

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON.

REPORT NO. 30, DEKHAN, POONA DISTRICT.

BY R. C. WROUGHTON AND WINIFRED M. DAVIDSON.

COLLECTION	No. 30.
LOCALITY	Dekhan.
DATE	January to May, 1918.
COLLECTED BY	Capt. Philip Gosse, R.A.M.C.
EARLIER REPORTS :— ..	For previous reports, see Vol. XXV., p. 472, 1918.

Captain Philip Gosse, R.A.M.C., has presented to the Mammal Survey a collection of 250 mammal specimens got together by him during a short tour of service in India. The specimens are from two distinct localities, and we propose to deal with them in two separate Reports.

Somewhat the larger half of the specimens, 137 altogether, are from the Dekhan (*i.e.*, from Poona and the neighbourhood); and these are dealt with in the present Report.

The collection comprises 31 forms distributed over 23 genera.

As was to be expected, there are, with the exception of a hitherto unknown *Funambulus*, and a new form of Wrinkle-lipped Bat, no strikingly new forms, nor even forms new to the Mammal Survey list; but as linking up the East Khandesh and Satara (Koyna Valley) collections this collection is of considerable interest.

From the point of view of distribution the capture of *Felis rubiginosa* at Khandalla is a great surprise, for hitherto it has not been found North of Dharwar.

The following is a detailed list of the specimens on the same lines as in former Reports, except that we have omitted the references to former Reports, as these are easily traceable from the Summary recently published in this Journal.

(1) PTEROPUS GIGANTEUS GIGANTEUS, Brunn.

The Indian Flying-Fox.

(Synonymy in No. 2.)

Poona, ♂ 2.

"Common, feeding at night on certain trees. Shot feeding on Pepul tree."—P. G.

(2) CYNOPTERUS SPHINX SPHINX, Vahl.

The Common Plantain-Bat.

(Synonymy in No. 6.)

Poona ♀ 1.

"While in verandah at Sassoon Hospital the large bat I have seen three or four times during the month flitted in. Rushed for net: when I got back it was hooked up on centre rafter. Got it and nearly broke the electric light with same stroke."— P. G.

(3) PIPISTRELLUS MIMUS, Wrought.

The Common Dwarf Pipistrel.

(Synonymy in No. 1.)

Poona, ♂ 2.

No. 58. "Shot while hawking over nullah one mile above Wanowri."
No. 238. "Shot flying about our compound."—P. G.

(4) PIPISTRELLUS COROMANDRA, Gray.

The Common Indian Pipistrel.

(Synonymy in No. 5.)

Poona, ♂ 7 ; ♀ 1.

Two of these specimens are indicated by Capt. Gosse as having been taken in the Sassoon Hospital. No. 76 had "many red ticks."

(5) SCOTOPHILUS WROUGHTONI, Thos.

The Lesser Indian Scotophil.

(Synonymy in No. 1.)

Poona, ♂ 5 ; ♀ 2 ; ? 2.

"Common."—H. G.

(6) SCOTOPHILUS KUHLI, Leach.

The Yellow Scotophil.

(Synonymy in No. 1.)

Poona, ♂ 2.

(7) TADARIDA GOSSEI, Wroughton.

Gosse's Thick-tailed Wrinkle-lip.

1891. *Nyctinomus tragata,* Blanford. Mamm. No. 224.
1918. *Tadarida gossei,* Wroughton, J.B.N.H.S., XXVI, 733.

Poona, ♂ 4 ; ♀ 2.

From Sassoon Hospital.

"They have a very strong, musty scent. Very loud shrill squeak when pairing, or when caught by me, in daytime. Also squeak in pairs in daytime, behind the chicks."—P. G.

(8) PACHYURA PERROTTETI, Duvern.

The Indian Pigmy Shrew.

(Synonymy in No. 4.)

Poona, ♀ 1.

"Caught with cheese bait among stones."—P. G.

(9) PACHYURA BLANFORDI, J. And.

Blanford's Musk-Shrew.

Poona, ♂ 4 ; ♀ 3 ; ? 2.

Khandalla, ♂ 3 ; ♀ 4.

The specimens constituting this very uniform series are topotypes of Dr. J. Anderson's *blanfordi,* and undoubtedly represent that species. Whether the name will stand, however, only further research will show : it is here used provisionally until the confusion in which this difficult genus at present remains has been reduced to order. Meanwhile it is noticeable that Capt. Gosse's specimens agree in every detail as to proportions and coloration with the original description. J. A. S. B., xlvi., pt. 2, p. 269.

"Common in and around bungalow."

"No. 8. Caught with dead bird, in bungalow. Three inguinal mammæ. Nos. 17 and 45. Caught with meat in house, and in a field, respectively. Nos. 31 and 50. Caught with cheese, in compound, and amongst rocks on mountain side, respectively. No. 108. Caught in jungle. Testes pale green colour."—P. G.

(10) Felis affinis, Gray.

The Jungle Cat.

(Synonymy in No. 1.)

Poona, ♂ 1 (skull only).

(11) Felis rubiginosa, Geoff.

The Rusty Spotted Cat.

(Synonymy in No. 5.)

Khandalla, ♂ 1.

"Trapped in ravine below cemetery. Iris pale gold."—P. G.

(12) Paradoxurus niger, Desm.

The Southern Toddy Cat.

(Synonymy in No. 5.)

Poona, ♂ 3, (one imm.)

With regard to No. 95 of the collection, a specimen covered with mange, Captain Gosse supplies the following note:—

"Caught in gin by Kerudin (my boy) last night in nullah behind 2, Victoria Road, Poona. 'Din' calls it a 'biju,' which is Hindustani for ratel. He also says it is sometimes called 'ood-bilaou', Hindustani for an otter. He explains its want of hair by the fact that it lives on dead men, and that this so heats the blood that its hair falls out!"—P. G.

(Apparently some confusion had arisen in the mind of Kerudin between this animal and the ratel, *Mellivora indica.* The common vernacular name of the present animal is of course "manuri.")

(13) Mungos mungo mœrens, Wrought.

The Common Dekhan Mungoose.

1915. *Mungos mungo mœrens,* Wroughton. Journ., B. N. H. S., Vol. XXIV, p. 52.

Poona, ♂ 1.

"Lived in cactus hedge near bungalow."—P. G.

(14) Mungos smithi, Gray.

The Ruddy Mungoose.

(Synonymy in No. 7.)

Khandalla, ♂ 1.

"Iris yellowish brown with tinge of red."—P. G.

(15) CANIS INDICUS KOLA, Wrought.

The Pale Indian Jackal.

1916. *Canis indicus kola*, Wroughton. Journ., B. N. H. S., Vol. XXIV p. 650.

Poona, ♀ 1.

(16) FUNAMBULUS PENNANTI PENNANTI, Wrought.

The Common Banyan Squirrel.

(Synonymy in No. 1.)

Poona, ♂ 2, ♀ 3.

"Very common. Caught among palm-trees on Mutha Canal Bank.
"No. 246. Mammæ two pairs inguinal."—P. G.

(17) FUNAMBULUS THOMASI, Wrought. and Dav.

Thomas's Forest Squirrel.

1919. *Funambulus thomasi*, Wroughton and Davidson. Journ., B. N. H. S., Vol. XXVI, p. 729.

Khandalla, ♂ 2, ♀ 3.

"No. 101. Pregnant. Two in utero.
"No. 107. Suckling. Two mammæ in groin. This specimen was singing when shot."—P. G.

(18) TATERA INDICA, Hardw.

The Common Antelope-Rat.

(Synonymy in No. 1.)

Poona, ♂ 4, ♀ 4.

"In cactus and rocks by a pond.
"Caught with rhodium."—P. G.

(19) VANDELEURIA OLERACEA OLERACEA, Benn.

The Common Indian Tree-Mouse.

(Synonymy in No. 2.)

Poona, ♂ 3, ♀ 2.

This is the first series taken under the Survey from the locality of Bennett's type.
"No. 18. Trapped with chapatti and rhodium in banyan tree.
"Nos. 19 and 41. Caught in banyan tree.
"No. 24. By millet field.
"No. 30. Caught with cheese on ground in garden. Strong 'mus' scent."—P. G.

(20) MUS URBANUS, Hodgs.

The Indian House-mouse.

1845. *Mus urbanus*, Hodgson, A. M. N. H., xv., p. 269.
1845. *Mus dubius*, Hodgson, ibid. p. 268.
1891. *Mus musculus*, Blanford. Mammalia, No. 282.

Poona, ♂ 3; ♀ 2.

Mr. Oldfield Thomas has pointed that the name *dubius*, hitherto used for this species in these reports, is not available, being antedated. Fischer (Syn. Mamm. p. 236, 1829), applies it to a Paraguay mouse described, but not named by Brants in his "Muizen", p. 185. Hodgson's *urbanus* must therefore be revived for the common ochraceous-bellied house-mice, as the next oldest available name.

"Nos. 78, 33 and 49. Caught in bungalow, No. 28 with cheese.

"Nos. 78 and 79. Caught in nullah behind bungalow."—P. G.

(21) LEGGADA BOODUGA, Gray.

The Indian Field-mouse.

(Synonymy in No. 1.)

Poona, ♂ 5; ♀ 1; ? 2.

Khandalla, ♀ 2; ? 1.

"Common.

"Nos. 10, 11 and 25. Caught with chapatti bait in and near millet field.

"No. 29. Caught in bank with cheese."—P. G.

(22) LEGADILLA PLATYTHRIX, Benn.

The Dekhan Leggad.

(Synonymy in No. 1.)

Poona, ♂ 2; ? 1.

Khandalla, ♂ 2; ♀ 3; ? 1.

"No. 64. Caught with chapatti bait.

"No. 102. Parasites under skin of head.

"No. 110. Pregnant. Six small embryos."—P. G.

Capt. Gosse further records that the strong smell of "mouse" perceptible in No. 113 was absent in No. 23.

(23) RATTUS RATTUS RUFESCENS, Gray.

The Indian House-rat.

(Synonymy in No. 1.)

Poona, ♂ 4; ♀ 1; ? 1.

Mr. Hinton in his recently published monograph of the *Rattus rattus* group (J. B. N. H. S., XXVI, p. 59, 1918) has restricted the sub-specific name *rufescens* to the shorter-tailed variety of the rufous backed, rusty bellied rats commensal with man.

"Common in houses.

"Nos. 2 and 3. From plague-infected house.

"No. 9. Caught with dead bird for bait in skinning room.

"Nos. 35, 36 and 39. Trapped in bank of dry nullah away from houses. The first was caught with cheese and chapatti. It shows no staining by purple cactus juice."—P. G.

(24) RATTUS RATTUS ALEXANDRINUS, Geoff.

The Egyptian House-rat.

1812. *Mus alexandrinus*, Geoffroy, Descr. d'Egypt. II, p. 733. Atlas pl. v., fig. 1.

1891. *Mus rattus*, Blanford. Mammalia, No. 272.

Poona, ♂ 3; ♀ 1.

In his above mentioned study of the *Rattus rattus* group, Mr. Hinton accepts Geoffroy's *alexandrinus* for the grey-bellied gray or brown house-rats. Four out of the five adult specimens show the white "caste mark" on the forehead, showing that they represent the "Mus brahminicus" form of Maj. R. E. Lloyd, I.M.S.

(25) RATTUS BLANFORDI, Thos.

The White-tailed Rat.

(Synonymy in No. 2.)

Khandalla, ♂ 4; ♀ 2.

"No. 56. Caught with chapatti amongst some rocks on side of mountain.

"No. 103. Caught at foot of big tree.

"No. 111. Trapped on bank of mountain torrent.

No. 112. Mammæ: one pair in each groin, one small in axillæ. Four large embryos in utero.

No. 116. Trapped with cheese, chapatti and aniseed, on ledges of rock in nullah."—P. G.

(26) MILLARDIA MELTADA MELTADA, Gray.

The Dekhan Metad.

(Synonymy in No. 1.)

Poona, ♂ 3; ? 2.

(27) GOLUNDA ELLIOTI, Gray.

The Common Bush Rat.

(Synonymy in No. 1.)

Poona, ♀ 1, ? 1 juv.

(28) GUNOMYS KOK, Gray.

The Common Mole-rat.

(Synonymy in No. 1.)

Poona, ♂ 1.

"No. 14. Among cactus and rocks, by a pond near bungalow. Bait: chapatti and oil of rhodium. Skin fairly tough."—P. G.

(29) LEPUS NIGRICOLLIS, Cuv.

The South Indian Hare.

(Synonymy in No. 5.)

Poona, ♂ 1; ? 1.

Khandalla, ♀ 1.

(30) MOSCHIOLA MEMINNA, Erxl.

The Indian Chevrotain.

(Synonymy in No. 6.)

Khandalla, ♂ 1; ♀ 1; ? 1 (skull only).

"Shot with bow and arrow. The female suckling; two mammæ. —P. G.

(31) SUS CRISTATUS, Wagn.

The Indian Wild Pig.

(Synonymy in No. 5.)

Khandalla, ? 1 (skull only).

REPORT No. 31, NILGIRIS.

BY R. C. WROUGHTON AND WINIFRED M. DAVIDSON.

COLLECTION ... ... No. 31.
LOCALITY ... ... NILGIRIS.
DATE ... ... June-July, 1918.
MADE BY ... ... Capt. P. Gosse, R.A.M.C.
EARLIER REPORTS :— ... For previous reports, see Vol. XXV., p. 472, 1918.

The major part of Capt. Gosse's collection was dealt with in the last Report, the balance here discussed was made in the Nilgiris during June and July, 1918, and considering the very short time available seems to be fairly representative. It is to be hoped that when the Survey collecting parties are reorganised a further investigation of this area may be made, as it promises to be very interesting.

Capt. Gosse's collection here amounted to only 113 specimens, representing 28 forms in 22 Genera.

A *Funambulus* from Kotagiri proves to be new, otherwise the retaking of *Leggada famula* is the most striking result of the collection. This species was originally taken by Mr. Charles Gray at Coonoor, in 1897, and was described by Bonhote in this Journal (Vol. XII, p. 99, 1899) and has since been known only by the type specimen.

The following is a detailed list of the specimens :—

(1) MACACA SINICA, L.

The Bonnet Macaque.

(Synonymy in No. 5.)

Kotagiri, ♂ 1, ♀ 1.

These specimens were shot together, "close to bungalow, Rookery Estate."

(2) PIPISTRELLUS COROMANDRA, Gray.

The Common Indian Pipistrel.

(Synonymy in No. 5.)

Kotagiri, ♂ 1, ♀ 2.

(3) SCOTOPHILUS KUHLI, Leach.

The Common Yellow Bat.

(Synonymy in No. 1.)

Kotagiri, ♂ 1, ? 2.

(4) PACHYURA, sp.

Musk-Shrews.

Ootacamund, ♂ 19, ♀ 7.

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

This perfectly consistent series corresponds with the Ceylon species *montana*, Blyth, in both measurements and colouring, though it has not yet been ascertained to what degree the latter character is of value. No name, however, can with confidence be given to the present series until this very difficult genus has been worked out.

" Very common in banks by roads.

" No. 157. The strongest-smelling specimen I have yet met.

" No. 192. Three mammæ, each inguinal. Bare patch each side behind axilla ; in the short stiff hair in centre is the musk gland."—P. G.

(5) FELIS AFFINIS, Gray.

The Jungle Cat.

(Synonymy in No. 4.)

Ootacamund, ♀ 1.

(6) FELIS BENGALENSIS, Kerr.

The Leopard Cat.

(Synonymy in No. 11.)

Ootacamund, ♀ 1.

(7) VIVERRICULA MALACCENSIS, Gmel.

Small Indian Civet.

(Synonymy in No. 3.)

Ootacamund, ♀ 1.

(8) MUNGOS VITTICOLLIS, Benn.

The Stripe-Necked Mungoose.

(Synonymy in No. 11.)

Ootacamund, ♀ 3.

A reward was offered for " Vermin " by the District Forest Officer at Ootacamund, who kindly permitted Captain Gosse to select any specimens he wanted. One of the present series, as also specimens of *Mungos mungo ellioti*, *Lutra lutra* and *Cuon dukhunensis*, were obtained in this way.

(9) MUNGOS MUNGO ELLIOTI, Wr

The Common Carnatic Mungoose.

(Synonymy in No. 22.)

Ootacamund, ♀ 1.

(10) LUTRA LUTRA, L.

The Common Otter.

(Synonymy in No. 11.)

Ootacamund, ♀ 1.

(11) AONYX CINEREA, Illig.

The Clawless Otter.

(Synonymy in No. 11.)

Ootacamund, ♀ 2.

(12) MELURSUS URSINUS, Shaw.

The Sloth Bear.

(Synonymy in No. 11.)

Kotagiri, ♀ 1.

(13) CANIS NARIA, Wrought.

The South Indian Jackal.

1916. *Canis naria*, Wroughton. Journ., B. N. H. S., Vol. XXIV, p. 651.
Ootacamund, ♀ 1.

(14) CUON DUKHUNENSIS, Sykes.

The Indian Wild Dog.

(Synonymy in No. 2.)

Ootacamund, ♀ 11.

Kotagiri, ♀ 1 (skull only).

(15) PETAURISTA PHILIPPENSIS, Ell.

The Madras Flying-Squirrel.

(Synonymy in No. 6.)

Kotagiri, ♂ 1, ♀ 1.

" No. 213. Out of hole in tree below tea factory."—P. G.

(16) RATUFA INDICA CENTRALIS, Ryl.

The Bombay Giant Squirrel.

(Synonymy in No. 5.)

Kotagiri, ♂ 1, ♀ 1.

Coimbatore, ♀ 1.

" Common in bamboo belt in Fever Belt at foot of Nilgiris.
" No. 227. Mammæ, three pairs abdominal."—P. G.

(17) FUNAMBULUS GOSSEI, Wrought. and Dav.

The Nilgiri Forest Squirrel.

(Synonymy in No. 5.)

Kotagiri, ♂ 5, ♀ 1.

Coimbatore, ♀ 1.

" 219. Mammæ, two pairs inguinal. Suckling."—P. G.

(18) FUNAMBULUS SUBLINEATUS, Waterh.

The Malabar Pigmy Palm-Squirrel.

(Synonymy in No. 11.)

Kotagiri, ♂ 1.

' A tag of skin 16 mm. long, covered with short hairs, in region of umbilicus."—P. G.

(19) MUS URBANUS, Hodgs.

The Indian House-Mouse.

(Synonymy in No. 30.)

Ootacamund, ♂ 2.

Kotagiri, ♂ 1, ♀ 2.

"Nos. 143 and 200. Caught (respectively) in Highbury House, Ootacamund, and in my bedroom at the Blue Mountain Hotel, Kotagiri.

"Nos. 208 and 209. Mammæ five pairs, three pectoral, two inguinal.' —P. G.

(20) Leggada famula, Bonh.

The Nilgiri Wild Mouse.

1899. *Mus famulus*, Bonhote. Journ., B. N. H. S., Vol. XII, p. 99.

Ootacamund, ♀ 1.

Coonoor, ♂ 1.

The re-taking, after an interval of over twenty years, of *Leggada famula* hitherto known only by the type in the British Museum, is, as noted in our Introduction, of much interest in the history of Indian mammalogy. The two specimens collected by Captain Gosse agree absolutely with the type and with Bonhote's description and plate. They show the outstanding character of long, soft, dense fur. The colour above is a very dark brown sprinkled with a coppery tinge, and hardly lighter below, with a wash of ochraceous, having no very sharp line of demarcation from the dorsal colour. The hands and feet are dark brown, and the tail coloured like the back, but slightly lighter below. Captain Gosse's record, printed below, of the number of mammæ of the female adds to our knowledge of the species, as the type specimen is presumably a male.

Mr. Thomas, in his recent revision of the Indian mice (J. B. N. H. S., Vol. XXVI, p. 417, 1919), has revived *Leggada* for the longer-muzzled form, essentially Jungle mice, into which group this species naturally falls.

"No. 127. Caught in evergreen jungle in glen below Hatherly Cottage. Mammæ three pairs, two inguinal, one axillary."—P. G.

(21) Leggada booduga, Gray.

The Indian Wild Mouse.

(Synonymy in No. 1.)

Ootacamund, ? 1.

Kotagiri, ♂ 1, ? 1.

Coonoor, ♂ 2.

"No. 129. From clearing in evergreen jungle."—P. G.

(22) Leggadilla grahami, Ryl.

The Lesser Coorg Leggad.

(Synonymy in No. 11.)

Kotagiri, ♂ 1.

(23) Rattus rattus wroughtoni, Hint.

The Nilgiri Tree-Rat.

1919. *Rattus rattus wroughtoni*, Hinton. Journ., B. N. H. S., Vol.XXVI., p. 384.

Ootacamund, ♂ 1, ♀ 5.

Kotagiri, ♂ 1

Mr. Hinton has, in the monograph above referred to, given the name of *wroughtoni* to the white-bellied wild rats of the Nilgiris.

"No. 128. Among big rocks, evergreen jungle. Mammæ, three pairs inguinal, one axillary.

"No. 148. Caught in Highbury House. Very wasted and thin.

"No. 197. Large vaginal orifice quite separate from urethral."—P. G.

(24) RATTUS RATTUS RUFESCENS, Gray.

The Indian House-Rat.

(Synonymy in No. 1.)

Ootacamund, ♂ 1.

Kotagiri, ♂ 1.

"No. 164. Parasites in spirits: very rapid runners."—P. G.

(25) MILLARDIA MELTADA MELTADA, Gray.

The Dekhan Metad.

(Synonymy in No. 1.)

Ootacamund, ♂ 6, ♀ 3.

Coonoor, ? 1, (skull only).

"Caught in bank. This species is always verminous—see specimens in spirits. They bleed freely from trap-wound."—P. G.

(26) GUNOMYS KOK, Gray.

The Common Mole-Rat.

(Synonymy in No. 1.)

Ootacamund, ♂ 1, ♀ 1.

Kotagiri, ♀ 1.

Coonoor, ? 1, (juv.).

"No. 190. Caught in garden at mouth of large burrow in soft earth. Bait, bread."—P. G.

(27) LEPUS NIGRICOLLIS, Cuv.

The South Indian Hare.

(Synonymy in No. 5.)

Kotagiri, ♀ 1.

(28) BIBOS GAURUS GAURUS, H. Sm.

The Common Gaur.

(Synonymy in No. 6.)

Kotagiri, ♂ 1, (skull only).

PROGRESS OF THE MAMMAL SURVEY.

It was decided by the Committee in March 1919 to proceed with the Mammal Survey as soon as collectors and additional funds could be obtained.

Mr. C. A. Crump was unable to return to India owing to his having been wounded in France and Lt. G. C. Shortridge not being available at present the Society engaged Mr. H. W. Wells to come out as a collector.

Mr. Wells arrived in India in September 1919 and proceeded at once to Assam, which province it is particularly desirable should be worked next. Mr. Wells went first to Margherita and thence to Sadiya and although he reports the jungle as too thick at present to do much trapping, it is hoped that before long, conditions will improve. It is requested that all members in Assam will try and help our collector. The Society has already to thank the following members and others for their promises of assistance to Mr. Wells:—

The Hon'ble Sir Beatson-Bell, K.C.I.E., C.S.I., Chief Commissioner, Assam.
Mr. H. E. P. Gill, Cachar, Assam.
Mr. A. J. W. Milroy, I.C.S., Gauhati, Assam.
Capt. G. A. Nevill, Balipara, Assam.
Mr. H. R. Cooper, Margherita, Assam.
Mr. A. Locket, Jorhat, Assam.
Mr. H. O. Allan, Darrang Game Association, Tezpur.
Mrs. F. E. Jackson, Tura, Garo Hills, Assam.
Mr. A. M. Primrose, Kalliani, Assam.
Mr. L. Bishop, Badlipar, Assam.

If sufficient funds are available it is hoped to bring out shortly a second collector so that the Survey can be more quickly finished.

The following additional subscriptions have been received since the list published at page 656 of this Volume (May 1919):—

Names.				Amount.		
				Rs.	a.	p.
Amount previously acknowledged in Journal No. 2, Vol. XXVI				12,964	1	1
Boalth, V. H.				15	0	0
Brown, G.				10	0	0
Comber, E.				1.000	0	0
Central Provinces Government				2.500	0	0
Evans, Lt.-Col. W. H.				50	0	0
Gaye, W.				10	0	0
Gharpurey, Major K. G.				50	0	0
Heath, R. H.				3	8	0
Ingoldby, Capt. C. M.				30	0	0
Inman, Major H. M.				10	0	0
Millard, W. S.				1,000	0	0
Mackwood, F. M.				100	0	0
Napier, A. G. F.				10	0	0
Porbandar, H. H. The Maharaja Rana Saheb				250	0	0
Swithinbank, Mrs. D.				30	0	0
Triggs, Bernard				20	0	0
Watson, Lt.-Col. H. R.				10	4	0
Whistler, H.				10	0	0
	Rs.	a.	p.	Rs. 18,073	13	1
Interest credited by Bank on Current Account up to 30th June 1919	30	15	0			
Interest on Bombay Port Trust Bonds up to the end of December 1919	93	12	0	124	11	0
				Rs. 18,198	8	1

Since May 1915 the Expenditure amounts to Rs. 6,000-12-0 leaving a balance in hand of Rs. 12,197-12-1.

OBITUARY NOTICES.

F. HANNYNGTON, I.C.S.

Frank Hannyngton was the youngest son of the late Mr. John Child Hannyngton, a Madras Civilian, who for a long time was Judge of Salem and spent the last 15 years of his service as Resident in Travancore. He was well known as "Curly" to the oarsmen of Trinity College, Dublin, where he became Captain of the boats. From Dublin he went to Wren's to prepare for the I. C. S. examination, which he passed in 1897, returning subsequently to Trinity College for his year's probation. At Wren's and in later life he was known as the "Bishop". Like many Irishmen he was a great lepper and one of his accomplishments was to kick a top hat held at arm's length over the head.

Hannyngton started his service in India on January 30th, 1899, as Asst. Collector and Magistrate, South Arcot. During the early part of his career he served at Tinnevelly, Malabar, Madras and Ootacamund putting in some time as Private Secretary to H. E. the Governor. In 1906 he went into the Postal Department and was successively Postmaster-General of the Punjab, the United Provinces and Bengal. In 1912 he reverted to the Madras Government being put on special duty in Madras and in the same year he was appointed Commissioner of Coorg which post he held up till the end of 1918 when he was transferred to Bellary. In March he went on leave and on his way home died in Bombay early in April 1919.

Hannyngton was always deeply interested in Natural History and in 1897, when at Naini Tal, took up butterfly collecting, to which pursuit he devoted most of his spare time. He made a very fine collection of the butterflies of Kumaun regarding which he published a paper in the Journal (XX. p. 131 & 871): in this he described a new *Zephyrus* under the name of *triloka*, which afterwards proved to be a form of *Zephyrus syla*. Later he published notes on the life history of *Vanessa indica* and *caschmirensis* and of *Papilio ravana*, also notes on the distribution of *Lethe kansa* and *Euthalia patala*. While P. M. G. of Bengal, he sent collectors up the Chumbi valley and secured a new *Parnassius*, which Mr. Avinoff has named *hannyngtoni* (T. E. S. 1915, p. 351). In Coorg he again made a most complete collection of the local butterflies and published a note on them in the Journal (XXIV. p. 578). Amongst the butterflies he captured in Coorg were a most interesting series of *Mycalesis*, which have not yet been worked out.

Hannyngton's death was a blow to all his friends; he was "one of the very best." He joined the Society in 1908 and became a member of the Committee in 1913. He had great hopes of succeeding to his father's job of Resident in Travancore and working out the butterflies in that province, which are not as well known as they should be.

He married in 1905, Maisie, daughter of Col. Forbes.

E. V. ELLIS, I.F.S.

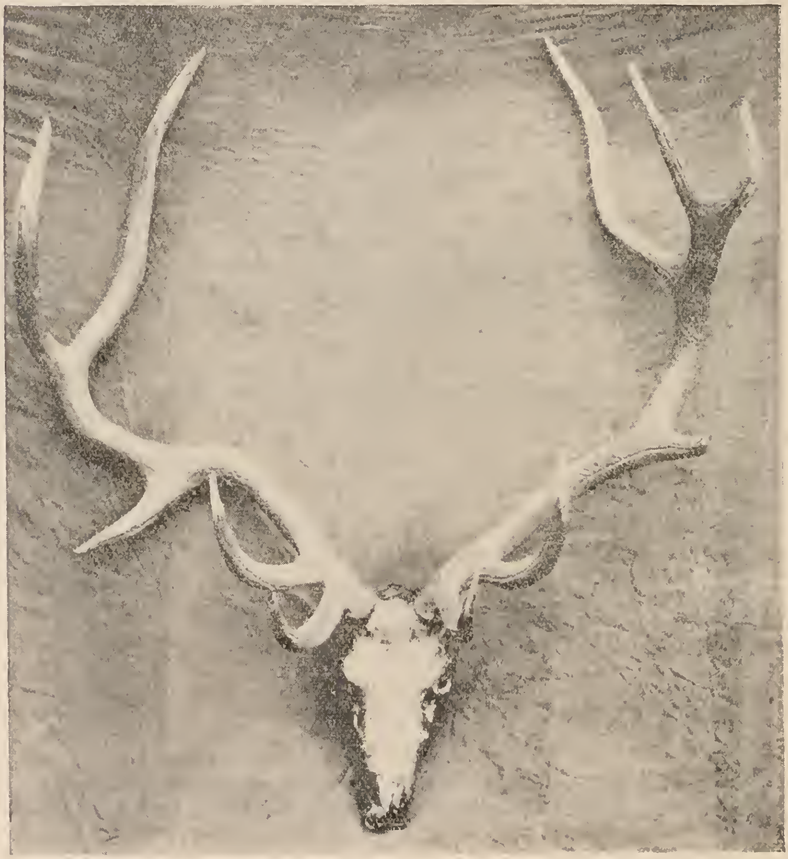
Amongst the numerous young men that have fallen during the war is E. V. Ellis of the Burmah Forests. He was an ardent entomologist and would have made a great name had he lived. He started collecting about 1912 and had done tremendous execution amongst the butterflies of Burmah. In Vol. XXV, p. 104 of the Journal, he wrote a very comprehensive note regarding the butterflies of the Tharrawaddy and Pegu Yoma, while in Vol. XXIII, p. 585, he described a new *Penthema* under the name *yoma*. He had made several trips into the Shan States and Maymyo, etc., and had added the very interesting *Mandarinia regalis* to the Burmese butterfly list. He had also visited the little known Coco Islands, North of the Andamans, finding the fauna, etc., in all respects Andamanese. Butterfly collectors of the Ellis type are very rare and his loss is a very serious one.

MISCELLANEOUS NOTES.

No. I.—LARGE KASHMIR STAG HEAD (*CERVUS CASHMIRIANUS*).

The enclosed photograph measurements of a Kashmir Stag (*Cervus cashmirianus*) may be of interest to some of your readers. The horns were measured by Major Wigram, K. O. S. Borderers, the Secretary, Game Preservation Department, Kashmir State.

Length—left 48, right 51½ inches.
Girth—6½ inches.
Tip to tip—21 inches.
Outside spread—41½ inches.
Points—6+5 =11 inches.



The stag was shot in one of the side nullahs of the Liddar Valley within a day's march of Bijhehare, and was well-known locally, as he used to stay at one or other of the lower valleys annually, when driven down by the snow. He was very wily as had been fired at and missed several times and was believed by the local villagers to be invulnerable owing to his being possessed by a protecting "*Shaitan*."

The head is the largest that has been shot in Kashmir for some years past. There is, I believe, one larger head in Rowland Wards Record of Large Game.

C. GILBERT ROGERS,
CHIEF CONSERVATOR OF FORESTS, BURMA.

MAYMYO, UPPER BURMA,
11*th August* 1919.

[According to Rowland Ward's Records of Big Game "The finest pair of antlers appears to be one given by Raja Gulab Singh, many years ago to Colonel King, then Commanding the 14th Hussars, at whose death they passed to Captain Prettyjohn of the same regiment. What became of these antlers Mr. A. O. Hume, who measured them in Meerut in 1852 or 1853, could not ascertain. The record stands, R. 52, L. 53½, measured along the curve inside. Girth 10 inches at burr, and 7 half-way between bez and trestines. They were a wide branching, symmetrical pair."

Mr. C. Gilbert Roger's head appears to come next to this head, the first given in Ward's list being one belonging to Mr. K. S. Laurie, shot in the Liddar Valley and measuring as follows :—

Length on outside curve	48½″
Circumference between bez and trez ..	7½″
Tip to tip	14″
Widest inside	33″
Points	7+5

EDS.]

No. II.—PORCUPINE'S METHOD OF ATTACK.

I have been very much interested by the recent correspondence as to the methods employed by Porcupines for using their quills either in offence or defence, and as I have had practical and painful experience of their methods I would like to state what I know on this subject. In February 1918, in Mesopotamia, while in camp near Samarra on the R. Tigris, I had the good fortune to dig out a couple of adult Porcupines from their earth amidst some ancient ruins.

I did not actually see the animals dug out, as it took the best part of a day for a couple of dozen men at least to accomplish the task, but when they eventually cornered the creatures it was only with the aid of numerous garments and pieces of clothing that they could capture them—and from the state of some of the clothing that I saw, the Porcupines seem to have put up a good fight.

When I saw the animals in the evening, they had leather collars round their necks and were fastened to stout stakes driven into the ground and appeared rather dazed and very frightened.

I was standing a few feet from one of them talking to a youngster who had been instrumental in their capture, when I suddenly received a terrific blow on my shin which all but knocked me over.

It was exactly as if I had been dealt a severe blow with a pick helve or stout wooden cudgel—and fortunately for me I was wearing thick putties and riding breeches, and two pairs of socks at the time, but even then a few of the animals' quills penetrated nearly half-an-inch into my leg and for a short while the pain was agonizing.

For many days my leg was very stiff and sore and I carried a large bruise for over a fortnight to remind me of the incident.

What had happened was this—the Porcupine had suddenly launched itself backwards with incredible speed and hurled its hindquarters against my legs, and as the beast, when dead, weighed over 25 lbs., the resultant shock was no joke.

Now just above the tail extremity the Porcupine has a small compact bunch of stout white quills a few inches only in length and it was with these, backed up by the speed and weight of its body, that it had given me such a terrific blow.

These little quills looking almost like a bunch of toothpicks, though they are of course extremely solid and strong, appear to me to be the real offensive and defensive weapons of the Porcupine.

They do not come out easily, but make a powerful impression on the mark they strike—while if the object aimed at is a large one, many of the longer quills also take effect and these, not being so firmly fixed into the creature's skin come out and remain embedded in the victim, which probably gives rise to the stories that the Porcupine uses its long quills mainly for use on its enemies and also that it can throw its quills several feet.

The creature's movements on such occasions are so swift that probably it is hardly noticed that it has closed with its enemy and then resumed its original position.

As far as I can remember, this bunch of small quills is situated just above the rattles of the tail.

I wonder if any of your readers have had a similar experience, or have ever heard of such a case.

Keepers in Zoological Gardens would probably know quite a lot about the ways and methods of offence and defence adopted by these animals.

C. R. S. PITMAN.

C/o Grindlay and Co.,
August 1919.

No. III.—PORCUPINE'S METHOD OF ATTACK.

Lt.-Col. R. Light's Note on Porcupines on page 666 of Vol. XXVI, No. 2, of the Journal afforded very interesting reading; and also causes me considerable surprise. I have several times seen porcupines attacking dogs; and I have also seen a tame porcupine playfully attacking its owner —much to the owner's discomfiture! In either case the porcupine's method of attack was to turn completely round, and *run backwards* at the object of its attack. In the case of the dogs, the porcupines ran backwards at them (when at close quarters), left a few quills in them; and then advanced forward a few paces and waited for the *dogs* to advance, which, needless to say, they did not do.

In one case a porcupine was being chased by one of my dogs and suddenly stopped, with all its quills elevated, and to my horror I saw the dog leap right on top of the porcupine! The porcupine then went on its way, leaving the dog riddled with quills.

I have never seen or heard of a porcupine being able to turn its quills forward over its head and in fact I have frequently raised the quills of porcupines I have shot and have not been able to turn them beyond a vertical position.

Lt.-Col. Light's note causes me to surmise that the porcupines up North are of a different species—as they seem to be possessed with larger powers of raising their quills and in their mode of attack.

RANDOLPH C. MORRIS.

Honnamotti, Attikan, P. O.,
Mysore, 30*th July* 1919.

No. IV.—CARACAL (*FELIS CARACAL*) AND HUNTING LEOPARD (*CYNAELURUS JUBATUS*) IN MIRZAPUR, U. P.

The following notes on two uncommon mammals in Mirzapur District may perhaps be of interest in connection with the Survey.

On 28th December 1912, during a sambhar beat in light jungle about 25 miles S. of the Ganges, a small animal that I did not recognize came out at very close range. I blew a large piece of its back away with a 500 Express but it made off and took refuge in a small nala where it was shortly afterwards despatched with a shot gun. It proved to be a female lynx (*F. caracal*). My measurement made it 34 inches long (body 27 and tail 7) apparently a rather small example. Unfortunately the only memento I have of it are the claws, as shortly after I got the head mounted it was destroyed in a bungalow fire. This is considered locally a distinctly rare animal. I saw not long ago in the possession of a friend a very fine skin of a cheetah (*C. jubatus*) that had been killed in 1916 by villagers about 30 miles South of Mirzapur, which is on the Ganges near Benares. I think about 5 have been obtained in the last 25 years, one being shot while it was in the act of stalking a sambhar. The one whose skin I saw had been killed in the neighbourhood of a grassy plain which held some Black buck.

LUCKNOW, 10*th August* 1919. G. O. ALLEN, I.C.S.

[Mr. Allen's note on the hunting leopard is most interesting as very little is known about the distribution of this animal in India. The distribution of the hunting leopard in India, according to the latest books on Natural History is not correct and we would urge members to send in any information they have on the subject. Notes on old and recent records of hunting leopards would be most valuable. We have been for some time collecting old records and hope shortly to publish them. It is advisable when writing of this animal to call it the hunting leopard and not the cheeta, a name used in many parts for the leopard or panther, *Felis pardus*.—EDS.]

No. V.—FIELD RATS IN THE DECCAN IN 1879.

I notice in the last number of the Journal an interesting note on the probability of a rat plague in India following the famine prevailing last winter.

I served in the Sholapur District in 1879 and remember writing long reports dealing with the rats and no doubt other officers did the same and probably much information might be obtained from the Bombay Secretariat for the years 1879 and 1881. Government gave in 1879 rewards for killing rats, I think, a rupee per hundred. These were paid by the village officers of the big villages and were paid between (I think) 4 and 6 p.m. As a check on the payments, I used to ride over and appear unexpectedly about 4 and make the payments for the day in different villages. If the number of rats brought in was about the average it showed there was not much fraud, but when the payments were greatly above the day sample one knew something was wrong.

It gave one much information as to the various rats which were doing the damage—and when one examined the rats any woman brought for reward one could pretty well guess the type of village she came from. In the dry hilly villages these were almost all Indian Gerbilles; in the bagait villages they were the "kok" rat but the most destructive in that part were one or two species of spiny mice or rats.

The numbers of rats caused an immense increase in birds of prey. Nests of *Aquila vindhiana and Elanus caeruleus* being found everywhere and the birds already commencing to build before the young left their present nest.

We officials encouraged the payments of rewards though I doubt if it did good except in giving a livelihood to people who might otherwise have starved. The only castes that ate the rats were Mangs and Pardis and they kept fat and flourishing while the other poorer classes were in wretched condition. The rats continued in enormous numbers till the first rains which were heavy, and in the heavy black soil country thousands were drowned.

The rats seemed then to become diseased and died off very fast. I think they were troubled by a pale reddish brown tick but it is now a matter of 40 years ago and one does not remember all details.

I think the records in the Secretariat would give much information.

Castle Douglas, Scotland,
August 25th, 1919.

J. DAVIDSON (late I. C. S.).

No. VI.—NOTE ON THE EGGS OF *PRINIA INORNATA*, THE INDIAN WREN-WARBLER.

Hume in his Nests and Eggs of Indian Birds, 2nd Edition (Oates), page 304, Vol. I, says regarding the colour of the eggs of *Prinia inornata* "still more rarely it is a clear pinkish white. These latter eggs are so rare that I have only seen six in almost as many hundreds." Now it is a very curious fact that I have, here, in Gonda District U. P. found no less than 17 nests containing these pink or white variety of Prinias eggs.

During the whole of my time in India, now nearly 40 years, I have examined many hundreds of nests of this bird, but never came across this variety of eggs till now. Only once before have I seen them and this clutch was sent me in the nest by an Indigo Planter friend in Champaran. The nest had been attached to the leaves of the growing indigo plant and cut down when the indigo was being cut for manufacture. At the time I did not know what bird the eggs belonged to,though from the general markings of the eggs and construction of nest I presumed they were those of *P.inornata.*

Last year one of my men told me he had found a nest with 4 eggs but did not know the bird, so I went to identify it, and to my surprise and delight, they were the white variety of *P. inornata.* Since then during last season (1918) I have taken the following clutches—all of the white variety.

3rd July—4 eggs—fresh. In 'Akhora' brush.
17th ,, 4 ,, ,, In coarse grass, ('Khar').
25th ,, 3 ,, ,, In Sugar cane.
26th ,, 5 ,, ,, In 'munj' grass.
19th Aug.—3 ,, ,, ,, ,,

This season (1919) I have taken the following:—

17th July—1 egg fresh.. Nest in 'Akhora' bush. The man should not have taken this single egg. But waited for clutch.
29th ,, 5 ,, ,, In 'Munj' grass.
2nd Aug. 4 ,, ,, Sugar cane.
4th ,, 5 ,, Hard set. So left them to hatch out. In Sugar cane.
6th ,, 5 ,, Slighty set. In 'munj' grass.
9th ,, 5 ,, Fresh. Sugar cane.
12th ,, 4 ,, ,, 'Munj.'
16th ,, 6 ,, Slighty incubated. In jowari (Lahareah) growing crops.
16th ,, 4 ,, Fresh. Sugar cane.
19th ,, 4 ,, ,, ,,
21st ,, 5 ,, ,, 'Munj.'
21st ,, 5 ,, ,, Sugar cane.

They were all typical *inornata* nests. Attached to the leaves of the shrub, grass, or sugar-cane, I do not know the scientific name for 'Akhora' plant, but it is a very common shrub about here, and a very favourite nesting place for *P. inornata*, *P. socialis* and Tailor bird. The eggs also are a replica of the blue variety, only with the ground, white in place of blue. The markings are very beautiful shining up well on the white ground. Some have the etchings, but others only large blotches of colour of two shades, one clutch having hardly any of the white shining owing to their being clouded one with claret brick red.

There can be no doubt that these eggs are those of *P. inornata*. I was doubtful on shooting one bird, as it none resembled the description of *P. blanfordi*, but I sent it to Hugh Whistler who kindly identified it and confirmed the identification as *P. inornata*.

Now, nearly all these eggs have been taken in *one* locality, *viz.*, Wasirgung in this District, only two nests having been taken at Gonda itself. Of course it may be that this bird in other localities also lays white eggs as personally I have only examined nests in these two places, but my friend Mr. Hutchison, who has collected eggs in Gonda District for years has *never* come across this white variety: How can this be accounted for that in only one locality, practically in all India nearly every bird of this species lays white eggs? At Wasirgung, I only came across 4 nests with blue eggs. The general features of Wasirgung are in no way different from other parts of the District, except that there are some large pieces of water. Lakes in fact, but this cannot account for it.

As I think this is worth placing on record, I am sending you this note for the Journal, I am also sending you a bird skin, a nest, and a clutch of these eggs for the Society's Museum.

F. REED

GONDA, OUDH, *7th Sept.* 1919.

No. VII.—NOTE ON THE NIGHTJAR (*CAPRIMULGUS ÆGYPTICUS*).

I saw a curious sight the other day, which may be worth recording. I was motoring along the Gurmat Ali road at 4-30 p.m., on the 8th August and saw a number of Egyptian Nightjars (*C. ægypticus*) flying slowly and aimlessly about in the hot sun, they were not feeding at all, and the only explanation I can think of is that the excessive heat had made the ground too hot to sit on! The temperature on this particular day registered 121-7° It is curious, if my theory is correct that the birds had not the sense to settle length wise on the palm branches for the time being.

W. M. LOGAN HOME MAJOR, M.E.F.

MESOPOTAMIA, *August* 1919

No. VIII.—STRANGE BEHAVIOUR OF A WILD BIRD.

Whilst walking on the sands at Birchington, Kent. with my wife, I saw a Guillemot at the water's edge, so we walked over to look at it. It resisted my efforts at picking it up and managed to peck me once or twice; finally I managed to lift it up. It then became quiet and allowed us both to scratch its head. As several small boys were playing near by, I carried the bird out on to the rocks and threw it into deep water; it swam out to sea for a short distance, then turned round and faced me. I offered it a shrimp so it swam in and took it from my hand, finally climbing on to the rocks at my feet. We both again scratched its head and put it back into the water, being rather afraid the small boys might get hold of it. We then went home to tea and returned later to see how it was getting on. It was swimming about and feeding quite happily. I was unable to find any reason for its apparent tameness. The weather previously had not been rough, so there was no reason for exhaustion. I examined it carefully but could find no injury nor was it ill nourished and from the way it was feeding later on it did not seem distressed in any way. It occurred to me that this strange behaviour in a wild bird might prove of interest to your readers, so send it to you.

BIRCHINGTON-ON-SEA, KENT,
20th October 1919.

J. E. M. BOYD, M.C.,
MAJOR, R.A.M.C.

No. IX.—THE BLUE-BREASTED QUAIL (*EXCALFACTORIA CHINENSIS*) AT MIRZAPUR.

Mr. H. Branford of Mirzapore has just sent me for identification the skin of a small quail which he shot out of sugarcane, 4 feet high at Mirzapure, on 17th July 1919. It proves to be a male of the blue-breasted quail (*Excalfactoria chinensis*). As Mr. Branford states that in 23 years shooting in the locality he has not previously met with the species, and as Mirzapore appears somewhat out of its range, as given in Blanford and Oates' work you may care to insert this record in the Journal.

JHANG,
31st July 1919.

HUGH WHISTLER, F.Z.S.,
INDIAN POLICE.

No. X.—BIRDS OF DIFFERENT SPECIES NESTING IN COMPANY.

The frequency with which I have found nests of different species in the same tree rather surprised me. Dewar has, I think, noted in one of his books that the Oriole often builds in company with the Black Drongo and it must very often be the attractive presence of this excellent watchman that accounts for others choosing the same site for nesting purposes.

On several occasions I have found three or more nests belonging to different species in one tree and mention three cases.

19th June : A mango tree of small size contained, 20 feet up, a nest of the Black Drongo with four white eggs ; 5 ft. higher up was a nest of the Southern Green Pigeon with two eggs ; and slightly higher and to one side was the nest of a Red Turtle Dove with one egg.

20th June: In an ordinary sized mango were first of all a Red-vented Bulbul's nest containing two eggs, then a little higher a Jungle Babbler's with three eggs, then a S. Green Pigeon's with two eggs and finally a Black Drongo's containing two eggs.

7th July : A mango tree was the choice of a S. Green Pigeon (2 eggs), below it of a Black Drongo (3 eggs) and 10 ft. from the ground of a Red-vented Bulbul (2 young birds).

I took the Green Pigeons' eggs as they were of an unusual shape. By the 15th the Drongos had hatched out and there was another nest of a Green Pigeon with one egg.

LUCKNOW, *10th August* 1919.

G. O. ALLEN, I.C.S.

No. XI.—THE RED TURTLE—DOVE (*ŒNOPEPELIA T. TRANQUEBARICA*) IN UNAO, U. P.

With reference to the notes on this bird on pp. 157 & 581 of Vol. XXIII, I had noticed it in Unao in January 1914 often feeding along with the Indian Ring—Dove but I have no note of ever having seen many of them.

This year however on 19th June in the same district I noticed them in very large numbers on an open bit of ground that was once a Government babul plantation (it has nearly all been cut down now). I commenced to count a flock and found there were 26 cocks and a few hens.

I soon saw a bigger lot: this numbered over 50 including both sexes. In another flock there were over a hundred birds of this species.

They were all busyfeeding—this was early in the morning—in dense flocks which consisted entirely of this species as a rule. The whole bit of " usar " there was dotted with these flocks, the colour of the flocks making very conspicuous patches. They were breeding now as I took the first nest on May 6th. A couple of days later I took two eggs from one nest and three from another, all in the same babul tree.

The nest is so flimsy that it takes quite a lot of finding. In that tree was also a nest of the Large Grey Babbler containing eggs. There appeared to be several other Red Turtle Doves nests without eggs in this tree and they were evidently not deterred by my attentions as I took yet another nest on 17th June from this same tree.

This babul tree was evidently particularly popular with this species—it was not far from where I had seen so many of them—as I only found one or two other nests, in different trees, towards the end of June.

The place where I noticed these birds so numerous, was a spot I often visited while out nest huntingso presumably they were not all breeding in the neighbourhood at that time an any rate.

Lucknow, 10*th August* 1919. G. O. ALLEN, I.C.S.

No. XII.—ACCIDENTS TO VULTURES.

In Vol. 13 (1861) of the Ibis, Capt. Irby has recorded an instance of an Indian Long-billed Vulture (*Gyps indicus*) being caught inside a horse's belly. An interesting accident was described to me in August 1915 (I did not witness it myself) shortly after it had been observed.

A moribund ox was lying by the side of the Chakrata road in Dehra Dun. Vultures were hard at it and had picked out its eyes. One had evidently gone for the tongue and to do so had put its head right inside the ox's mouth. As an expiring effort or by some involuntary muscular contraction the mouth had closed tightly over the vulture's head the bird helplessly flapping its wings in its efforts to extricate it. The other vultures evidently realizing something was wrong held off.

Lucknow, 10*th August* 1919. G. O. ALLEN, I.C.S.

No. XIII.—HOVERING HABIT OF THE SPOTTED OWLET (*ATHENE BRAHMA*).

Is it a common habit with *Athene brahma* to hover? I happen to have twice noticed it. The first occasion was in February 1917 at Jaunpur when this little owl at dusk flew out from a tree and several times hovered for some considerable time over a barley field in different places. I saw exactly the same thing at Pinjaur in November 1918.

G. O. ALLEN, I.C.S.

Lucknow, 10*th August* 1919.

No. XIV.—A 17 SCALE KRAIT (*BUNGARUS CAERULEUS*) FROM BANGALORE.

I have just examined a very unusual specimen of the common krait. It is a juvenile example measuring 1 foot 8¾ inches. Tail 2½ inches. In this the scale rows instead of coming to 15 at or near the neck, remain 17 (or 16) for 11¾ inches behind the snout. I have carefully studied the lepidosis and find on the left side there are 8 rows of costals below the vertebral, until a point 11¼ inches from the snout. Here the 4th and 5th rows above the ventrals fuse and become 7 to the vent. At points 3½, 5¾, and 6¾ inches from the snout the 3rd and 4th, or 4th and 5th rows above the ventrals fuse, reducing the count to 7, but at each spot 3 scales later the 4th row subdivides to re-establish 8 rows. On the right side the costals are 8 to 11¾ inches behind the snout. At this point they become 7 by a fusion of the 4th and 5th rows above the ventrals and remain so to the vent. At points 4, 7¼ and 11¼ inches from the snout by a similar fusion the rows come to 7, but 3 scales later by a division of the 4th row, 8 costals are re-established. In this Journal (Vol. XXII, p. 402) I remarked upon two kraits from Jhelum, and Sholapur which I considered of the species *caeruleus*, and which showed a similar unusual departure from the normal. In both of these there were 17 scale rows in the entire body length. It occasionally happens that one sees an individual with a scale in the vertebral row here and there divided so as to bring the count to 17 at this particular spot. Prater has recorded such an example in this Journal recently (Vol. XXVI, p. 684). This aberration however is a very different one from that in which the costals exhibit a supernumerary row.

The specimen I have just remarked upon has the vertebrals as broad as in normal 15 scale kraits, and appears by colouration, and other features to be a *caeruleus*, and not a *sindanus*.

The arguments in favour of uniting *caeruleus* and *sindanus* under the former title, are becoming steadily more forcible.

F. WALL,
LIEUT.-COLONEL, I.M.S.

BANGALORE, 1*st August* 1919.

No. XV.—EARLY OCCURRENCE OF THE PAINTED LADY (*VANESSA CARDUI*, L.) IN THE DARBHANGA DISTRICT, BEHAR.

While going round my work this morning I saw a Painted Lady (*V. cardui* L.). It settled about a couple of feet in front of me, and then flew off for a short distance, settling again. I again went up to within a couple of feet of it to make sure of its identity. This species is not uncommon here from the beginning of March to the first few days of April. I have got specimens from the first of the former month up to the 4th of the latter one, but they seem commonest after the middle of March. I have not seen them here at any other time.

CHAS. M. INGLIS, M.B.O.U.

BAGHOWNIE FTY., LAHERIA SARAI,
14*th October* 1919.

No. XVI.—A CURIOUS METHOD OF FEEDING NOTED IN *DANAIS LIMNIACE*, Cram.

Late in May last a large swarm of *Danais limniace*, Cram., was found in the compound of our Laboratory in Bangalore on the numerous *Crotolaria striata* plants—with which a good portion of the Laboratory compound is covered. Each tender and succulent pod of the plants had not less than two or three butterflies on it. The insects were found very busy scratching up the surface of the pods with the claws of their middle pair of legs in a steady and persistent manner, the tip of the uncoiled proboscis following the scratched portions at the same time and sucking up the juice oozing out of the small wound. When a group of butterflies on a plant was disturbed they scattered away and soon after another group of them was found to settle on the plant and get very busy at the same work. After a group of butterflies were at a set of pods for about five minutes the surface of the pods was found to be scratched in patches. Except teak (*Tectona grandis*) no other plant or weed was found to be in blossom in or around the Laboratory compound. A few stragglers of *Euploea core*, Cram. were also found amidst the swarm of *D. limniace* feeding in a similar manner.

T. V. SUBRAHMANIAM,
JUNIOR ASSISTANT ENTOMOLOGIST.

DEPARTMENT OF AGRICULTURE,
BANGALORE,
8th August 1919.

No. XVII.—NOTES FROM THE ORIENTAL SPORTING MAGAZINE, JUNE 1828 TO JUNE 1833.

At page 311 of Volume XXVI, the writer expressed a hope to be able to collate some further notes from old sporting magazines, and is now able to furnish a few notes on the Old Series of the "Oriental Sporting Magazine."

Pig Sticking: At page 12 of the Magazine for June 1828 is the epic poem "The Next Grey Boar we See," and in the October number for 1830 is published the well known song "Saddle Spur and Spear," the author being "S. Y. S.".

In the same number the contributor of the doings of the Sholapur Hunt says that when at Deesa he killed the largest hog he had ever seen: 6 feet 1 inch long: tushes 10 inches.

This record gives a length longer by seven inches than any recorded at page 740 of Volume XXV of our Journal. It is unfortunate that the weight is not stated.

In March 1918 Major Gordon, R.H.A., speared a boar at Abu Jisra on the Diala River, which measured 38 inches at the withers and weighed 267 lbs. Had this animal been killed earlier in the year the weight would have been quite 300 lbs.: a monster indeed. I have no note of this length so a comparison with the Deesa boar is not possible.

Doings of the Ahmednugger Hunt and Tent Club are contributed to the 1829 issue, 18 hogs having been speared in the Godavery River direction between 23rd September and 8th October 1828.

Flint v. Percussion. In the October number of 1828 "Percussion" writes from Bombay under date 25th May to persuade those sportsmen still using "the good old flint lock" from ignorance or in a spirit of contradiction to discard it for a percussion lock.

Big Jumps. In the same issue is an extract from an English newspaper, the "Observer" of March 24th, 1828, which states that "a horse, the property of Captain O'Hanlon, whilst galloping the other day, in the vicinity of Cheltenham, covered, in a single bound, the enormous distance of thirty-five feet and a half."

Bears. In August 1830 the Magazine reproduces a Review, from the "London Literary Gazette," of the Field Sports of the North of Europe: 1827-28 by L. Lloyd, Esquire.

The Review is a lengthy one and many anecdotes are given as to bears of Scandinavia which, in the words of the Reviewer, "though doubtless founded on fact are occasionally, perhaps, a little embellished."

Of the "embellished" description is "a bear has been seen walking on his hinder feet along a small tree that stretched across a river, bearing a dead horse in his fore paws!" Readers can visualize the performance.

Of the "founded on fact" kind the maltreatment of an old soldier by an enraged bruin is of interest with reference to a similar occurrence related in our journal as having happened to a native near Mount Abu in Rajputana (Volume XXIV, page 354).

The old soldier who was so sadly mauled in 1790, was knocked over by the bear which seized him with his teeth by the back of the head as he was lying face downwards. The beast tore off the whole of his scalp from the nape of the neck upwards so that it merely hung to the forehead by a strip of skin which was severed by the surgeon who dressed the wound.

The scalp is described, when separated from the head, exactly resembling a peruke! It is not related whether the man recovered from this injury, but probably he did, as it is quaintly recorded that "having no hair he was unable to comply with the Regulations which required it to be worn in a certain form and so was discharged from the army!"

Bustard. A "Lover of all Sports" writes from Ahmednugger on 1st August 1829 to say that between 1809 when he killed his first bustard at 83 paces with No. 5 shot using a double barrel gun by H. Nock, and date of writing, he has bagged 961 bustard. He gives the weight of cock birds as varying from 18 to 32 lbs. and a few ounces, and of hens as from 8 lbs. to 15 lbs.

Sixteen years ago the present writer saw and shot bustard in the Hyderabad territory north of the Godavery River.

Riddles. In 1831, "J. G." propounds the riddle "why are snipes like the Bombay hawkers" and tells us as the answer "Because they are *Chorers* with long bills."

Tiger shooting. "Nimrod in the East", writing in July 1831, relates the doings of his party shooting in Khandeish. The bag for the period 7th April to 20th May was 46 tigers, 9 bears, 1 cheeta. Four elephants were used. Sportsmen who know the Tapti River country will be interested to see the names of the various places at which sport was then obtained; Shoda; Sultanpur; Perkassa; Tulloda; Bamungaum; Pimpalnair; Moolleir. 25 tigers and 4 bears were killed between 8th and 28th April inclusive.

A Tiger "Basket." A sporting contributor writing from Dharwar on 10th January 1832, describes the use of "a tiger basket," when following up a wounded beast. He describes the basket as being, perhaps, the best substitute for an elephant. It was about seven feet high, and large enough to hold three people comfortably, and made of bamboos so strong as to resist the charge of a tiger.

On the occasion in question the writer relates that he pitched his tiger basket fifteen yards from the bush in which the wounded animal lay, but the beast went out the other side and gave no opportunity. We may say for him that he was fortunate not to be charged before he got into his "basket."

R. W. BURTON, Lt.-Col.,
Indian Army.

Bareilly, *27th August* 1919.

No. XVIII.—AN ANOMALY IN FLORAL BIOLOGY.

In Papilionaceous flowers as a rule the standard (or vexillum) which is the largest petal is towards the posterior side and stands upwards, the two wings (alæ) are laterally situated and the keel petals (carina) which enclose the stamens and the pistil are directed downwards. The wings afford the landing place for the insects which get dusted with pollen on their ventral side or abdomen. In the following cases, however, the flowers become completely reversed so that the standard instead of the wings and the keel is brought down and forms the platform for the pollinating insect. The wings and keel petals on the other hand are carried up along with the enclosed stamens and the pistil, and insects will therefore receive the pollen on their back and not on their abdomen.

I. *Canavalia ensiformis*, DC.

(The Sword Bean).

The flowers are confined to the terminal portion of the raceme and by their own weight bring down this portion of the inflorescence which thereby resembles an inverted candelabrum. When the raceme thus hangs down the flowers also are completely inverted and the above mentioned anomaly results. When it does not droop, as it sometimes happens when it is small or few flowered, the inversion is brought about in another way.

The posterior two-lobed portion of the calyx together with the adjoining standard petal is heavier than the rest of the flower and is consequently pulled down by gravity helped by a slight torsion on the part of the pedicel. The flowers are also negatively geotropic so that those that are placed below when the inflorescence is horizontal are raised up in order to be exposed to light. This is very evident even in the bud stage.

It is interesting to note that the corolla changes its colour later in the day from pink to light purple, a signal to keep off insects, when no longer required. At the same time the standard approaches the tip of the keel and closes the entrance. Self-pollination is certain as the anthers and stigma mature at the same time, but I have also noticed flowers wherein the stigma projects beyond the level of the anthers. These must necessarily be cross-pollinated.

Among insect visitors I have observed the Carpenter bee. But the flowers are always infested with the large black ants.

Clitoria ternatea, L.

In this case the inflorescence is axillary and single flowered and the flower leans on its heaviest side borne by the short pliant pedicel. The standard is the largest petal and the wings and keel are much reduced.

In one flower that I examined the standard weighed, ·268 gm. whereas the wings and the keel together with the stamens and the pistil weighed only ·099 gm. The inversion therefore is clearly due to one-side weight. The flowers open from 5 to 10 A.M.,* and are visited by the common butterflies.

A similar peculiarity in floral biology has been recorded† for a species of *Erythrina*, viz., in *E. crista galli* a Brazilian species where the flower is said to be twisted through 180° (supination) so as to bring the standard downwards which affords the landing place for visitors.

II.

Pollination in Erythrina indica, Lamk.

According to Scott-Elliot‡ the flowers of *Erythrina caffra* (S. Africa) are ornithophilous, but the birds get dusted with pollen on their breasts. This observer also studied the arrangement in *E. indica* in Mauritius and says it is the same as in *E. caffra.* I am able to confirm this by my own observation in the Agricultural College, Botanical Garden, in February last. In this species which is common in S. India the wing and keel petals are much reduced and form a kind of cup in which the nectar is stored. The standard is large and bright, scarlet in colour but does not provide the platform for visitors. The flowers are densely and spirally arranged on the axes which radiate horizontally from the ends of branches. The stamens and pistil diverge from the standard and the stigma abruptly bends towards the standard. Scot-Elliot§ wrongly says it is below the anthers. It is on the other hand projected a little forward.

Between 8 and 9 in the morning I have seen crows making a prolonged stay in the branches and drinking nectar freely from the flowers. Fine little birds with long beaks and yellow breasts (?) which I have often observed in *Moringa* and *Adhatoda* are also constant visitors. These hop along the peduncle and thrust their beaks between the keel and the staminal column and drink the sweet juice. It is also a pleasing sight to see squirrels gently walk along the peduncle and taste the nectar. The plant really trades on very liberal terms with these creatures. To my great surprise I was able to draw 1½ C.C. of the nectar from 30 flowers. This comes to 5 C.C. per 100!

P. S. JIVANNA RAO, M.A.

LAWLEY ROAD, P.O., COIMBATORE,
7th August 1919.

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* C. E. C. Fischer in Bomb. Nat. Hist. Journ. Vol., XVII, p. 405.

† Knuth, Handbook of Flower Pollination, Vol. II, p. 338.

‡ Annals of Botany, Vol. IV. p. 263.

§ *Ibid.*

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of ACCOUNTS from 1st *January* 1918 *to* 31st *December* 1918.

RECEIPTS.	Rs.	a.	p.	Rs.	a.	p.
To OPENING BALANCE OF 1ST JANUARY 1918 ..	....			2,945	3	2
Amount advanced to Staff for War Loan ..	....			882	1	8
To Subscription for 1915 (in arrears)	15	0	0			
,, ,, ,, 1916 ,, ...	150	0	0			
,, ,, ,, 1917 ,, ...	450	0	0			
,, ,, ,, the current year	20,433	3	10			
,, ,, ,, 1919 (in advance)	737	6	7			
,, ,, ,, 1920 ,, ...	74	8	0			
,, ,, ,, 1921 ,, .. .	30	0	0			
,, ,, ,, 1922 ,, ...	15	0	0			
,, ,, ,, 1923 ,, ...	15	0	0			
,, Life Membership	585	0	0			
	22,505	2	5			
Less—Refund of Subscriptions ..	89	13	0			
				22,415	5	5
To Grant-in-aid from the Bombay Government.	5,000	0	0			
,, Entrance Fees	1,380	0	0			
,, Sales of Journal	2,550	10	1			
,, ,, ,, Snake Books	581	15	10			
,, ,, ,, White Auts Pamphlet .. .	4	4	0			
,, ,, ,, Mesopotamia Notes Pamphlets ..	38	2	0			
,, ,, ,, List of Butterflies	4	4	0			
,, Cost of Cartridges (recovered)	195	8	0			
,, Cost of Books recovered (charges recovered).	41	2	1			
,, Refund of Loan from Mammal Fund	400	0	0			
,, Insurance charges on Microscope recovered.	56	12	0			
Carried over ..	10,202	10	0	26,242	10	3

PAYMENTS.	Rs.	a.	p.	Rs.	a.	p.
By Journal Account	9,306	9	3			
,, Salaries..	8,350	6	0			
,, General Charges	744	0	3			
,, Rent	2,910	0	0			
,, Printing and Stationery	614	8	0			
,, Petty Cash Expenses..	408	2	9			
,, Postal Expenses	497	5	0			
,, Library Account	145	2	1			
,, Furniture Account..	233	8	0			
,, Audit Fee	130	0	0			
,, Fire Insurance Premium	231	6	6			
,, Pigeon Book	268	8	11			
,, Bonus to Staff	445	0	0			
,, Bank Charges	69	6	0			
,, Sundries	23	5	0			
				24,477	3	9
Closing Balances, 31*st December* 1918.						
Fixed Deposit with Eastern Bank, Limited ..	12,000	0	0			
Balance with National Bank of India, Limited ..	2,609	7	9			
Balance as per Postage Book	20	3	6			
Balance as per Petty Cash Book	97	10	5			
Advances recoverable from the Staff	593	0	4			
				15,320	6	0
Carried over .	....			39,797	9	9

STATEMENT of ACCOUNTS from 1st *January* 1918 *to* 31st *December* 1918—contd.

RECEIPTS.	Rs. a. p.	Rs a. p.	PAYMENTS.	Rs. a. p.	Rs. a. p.
Brought forward ..	10,202 10 0	26,242 10 3	Brought forward ..	.. .	39,797 9 9
To Cost of Spirit recovered	9 0 0				
,, Expenses recovered from General Keary ..	32 8 0				
,, Donations	54 8 0				
,, Registration Fees	239 8 0				
,, Sundries	257 3 6				
,, Interest of Investments	1,751 6 0				
,, ,, on Fixed Deposit	291 14 0				
,, ,, ,, Current Account	166 6 0				
,, ,, ,, War Bonds	550 0 0				
		13,554 15 6			
		39,797 9 9			Rs. 39,797 9 9
			Securities with the National Bank of India, Ld. Bombay.		
			3½ % Government of India Promissory Notes.	8,800 0 0	
			4 % Government of India Conversion Loan.	10,000 0 0	
			4 % Bombay Port Trust Unguaranteed Bonds	14,000 0 0	
			4 % City of Bombay Improvement Trust Bonds	15,000 0 0	
			5½ % War Bonds, 1920 Pro. Notes	10,000 0 0	
			Total ..	Rs. 57,800 0 0	

We have seen a letter from the National Bank of India, Limited, to the effect that the above Securities were held on the Society's behalf on 31st December 1913.

Examined and found correct.

(Sd.) L. H. SAVILE,
Honorary Treasurer.

(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors.

BOMBAY, 24*th February* 1919.

BOMBAY NATURAL HISTORY SOCIETY.

MAMMAL FUND ACCOUNT.

STATEMENT of ACCOUNTS from 1st *January* 1918 *to* 31st *December* 1918.

RECEIPTS	Rs. a. p.	Rs. a. p.	PAYMENT.	Rs. a. p.	Rs. a. p.
OPENING BALANCE ON 1ST JANUARY 1918.					
Fixed Deposit with Mercantile Bank	3,500 0 0		By Salary of N. A. Baptista	575 0 0	
Bombay Port Trust Ungtd. Bonds of Rs. 5,000 at cost	5,150 0 0		,, Allowance	176 12 10	
Balance as per Postage Book	1 5 0		,, Travelling Expenses	50 0 0	
Balance as per Petty Cash Book	15 2 2		,, Clothes, etc.	172 0 0	973 12 10
Balance with the National Bank	296 1 2	8,962 8 4	,, Freight on Specimen Boxes	16 11 3	
			,, Bank Charges..	1 1 0	
Donations received during 1918	733 11 1		,, Sundries	33 14 0	
Interest on Fixed Deposit	146 3 0		,, Refund of Loan Society	100 0 0	
,, Investments	187 8 0		,, Advance to Baptista for Rice	6 0 0	
,, Current Account	18 15 0		,, Clothes to Nissa	29 2 0	
Cost of Gun sold	150 0 0	1,236 5 1	,, Train fare, etc., to Nissa..	15 0 0	
			,, Postal expenses	8 3 6	
			,, Petty Cash Expenses	30 9 8	540 9 5
			Closing Balances, 31st December 1918.		
			Fixed Deposit with Mercantile Bank	2,000 0 0	
			Bombay Port Trust Ungtd. Bonds of Rs. 5,000 at cost	5,150 0 0	
			Balance of Postage	8 1 6	
			Balance of Petty Cash Book	9 8 6	
			Balance with National Bank	1,516 13 2	8,684 7 2
Total ..		10,198 13 5			10,198 13 5

(Sd.) L. H. SAVILE,
Honorary Treasurer,
Bombay Natural History Society.

BOMBAY, 24*th February* 1919.

PROCEEDINGS

OF A MEETING HELD ON 20TH AUGUST 1919.

A meeting of members of the Bombay Natural History Society took place on Wednesday, the 20th August 1919. The election of the following 13 new members since the last meeting was announced:—

Major G. C. Campbell, Meerut; Mrs. E. H. A. Nicolas, Barabanki; Major H. R. Lawrence, I. A., Hyderabad, Deccan; Mr. B. C. A. Allen, Calcutta; Capt. J. H. Boag, M.C., R.A.M.C., Jhansi; Mr. F. Thomas, Bombay; Dr. C. L. Digby Roberts, Kalimpong; Mr. E. W. Butler, Dooars; Mrs. W. Priestley, Bombay; Mr. A. A. Phillips, I.S.R., Mianwali, Punjab; Dr. Ida Colthurst, Calcutta; Capt. M. S. Harvey Jones, Mhow; and Capt. J. S. McLellan, Poona.

The following contributions to the Museum were received since the last meeting:—

Contribution.	Locality.	Donor.
1 Maccelland's Coral Snake, *Callophis macclellandi.*	....	Major R. Collis Hallowes, R.A.M.C.
1 Shaw's Striated Wolf Snake, *Lycodon striatus.*	Gonda, U. P. ..	F. Field.
1 The Common Krait, *Bungarus caeruleus.*		
23 Birds	Mesopotamia ..	Major W. M. Logan Home.
1 Levantine Viper, *Vipera libetina.*		
1 Speckled-bellied Racer or Dhaman, *Zamenis ventrimaculatus.*		
1 *Mus famulus*	Ootacamund ..	Capt. P. H. Gosse.
2 Indian Black Buck, *Antelope cervicapra.*	Dhar, C. I. ..	H. H. The Maharaja of Dhar.
18 Birds	Bandar-i-gaz, near Caspian Province.	Capt. C.M. Ingoldby.
17 Lizards		
12 Snakes		
1 Tortoise (alive)	Menjil, N. Persia.	Do.
1 Glass Snake-Lizard, *Ophisaurus apus.*		
1 Burmese Slow-Loris, *Nycticebus coucang.*	Bassein, Burma ..	....
8 Arabian Fruit Bats, *Rousettus arabica.*	Karachi	Capt. C. B. Ticehurst.
1 Snake	Aleppo	Major A. L. Mackenzie.
2 Skulls of Persian Gazelle, *Gazella subgutturosa.*	Sheik-Saad ..	Rev. Wormald.
4 Tortoises, *Bellia crassicollis, Testudo elongata, Geomyda grandis, H. annandalei.*	Near Bangkok. Hills near Chumporu, Siam.	Dr. Malcolm Smith.

Contribution.	Locality.	Donor.
4 Snakes, 2 *T. nuchalis*, 1 Eastern Bronze-back, *Dendrophis pictus*, 1 Banded Wolf Snake, *Lycodon faciatus.* 1 Worm .. .. .. 1 Scorpion .. .. .. 1 Pigmy Shrew	Thandaung Hills, Toungoo District. and Hlaw-ga, Burma, Rangoon.	Dr. H. H. Marshall.
1 Hodgson's Tree Mouse, *Vandeluria dumeticola*, with four young. 1 Hodgson's Grey-bellied Rat, *Rattus nitidus.*	Nagrispur, Darjeeling.	Mr. O. Lindgren.
1 Skin of Puff-adder	East Africa ..	Major K. G. Gharpurey.
1 Pallas' Squirrel, *Callosciurus erythraeus.* 1 Bamboo-Rat, *Rhizomys pruinosus.*	Manipur	Mr. J. P. Mills, I.C.S.
1 Large-Spotted Viper, *Lachesis monticola.*	Lebong, Darjeeling.	Mr. P. C. Lenton ..
1 Southern Grackle (alive), *Eulabes religiosa.*	Purchased ..	Mr. T. Davis, I.C.S.
1 *Zamenis*, 1 *Contia* and 1 Lizard.	Qizil Robat, Mesopotamia	Lt.-Col. H. D. Peile.
1 Javelin Sandboa, *Eryx jaculus.*	Mesopotamia ..	Mr. FitzGerald.
4 Jungle Squirrels, *Funambulus tristriatus.*	Trevandrum ..	Trevandrum Museum.
1 Malayan Dwarf Snake, *Calamaria pavimentata.* 1 Striped-bellied Keel-tail, *Trachischium monticola.* 1 Striped Kukri Snake, *Simotis cyclurus.* 1 Himalayan Bush Snake, *Tropidonotus himalayanus.* 1 The Common Green Viper, *Lachesis gramineus.* 1 Glass Snake Lizard, *Ophisaurus gracilis* (head only). 5 Lantern flies.	Tura, Assam. ..	Mrs. F. E. Jackson.
58 Birds, 2 Gerbilles .. 4 Eggs of White Stork *Ciconia alba.* 6 ,, of Magpie *Pica rustica.* 3 ,, of Collared Pratincole *Glareola pratincola.*	Mesopotamia ..	Major R. E. Cheesman. Major Genl. Sir Percy Cox.
1 Royal Snake, *Zamenis diadema.*	Jodhpur ..	Mrs. C. Patterson.

Minor contributions from :—Maharaj Kumar Vijayaraju of Cutch, Mr. L. Newcome, Col. Mereweather, Major H. Brown, Mr. T. H. Cameron, and Mr. N. B. Kinnear.

A paper on "The Power of Scent in Wild Animals," by E. C. Stuart Baker was read and then the meeting ended with a vote of thanks to the various contributors.

1520

Bombay Natural History Society.

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ON 1st FEBRUARY 1920.

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The Hon'ble Sir Norman Macleod.

H. H. Sir Shri Kengurji Sawai Bahadur, G.C.S.I., G.C.I.E., the Maharao of Cutch.

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Mr. R. A. Spence.

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Bombay Natural History Society.

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Bannerji, Girindra Ch. (B.A.)	Simultala, Bihar.
Bannerman, Surgeon-General W. B. (C.S.I., K.H.P., M.D., D.SC., I.M.S.), Retd.	*Europe.*
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Barron, P. A. R.	Lakon Lampang, Siam.
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Beg, Nawab Nazir Jung Bahadur Mirza Nazir	Hyderabad, Deccan.
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Bell, Dr. L. H. I.	*Europe.*
Bell, R. D. (C.I.E., I.C.S.)	Bombay.
Bell, T. R. (C.I.E., I.F.S.)	Karwar.
Bellairs, Major R. G. (O.B.E.)	Almora, U. P.
Bennett, H. C. (I.F.S.)	Mercara.
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Benson, Capt. C. E. (A.D.C.)	Bombay.
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Bhatia, G. R.	Dehra Dun, U. P.
Bhurie Singh, H. H. Sir (K.C.S.I., C.I.E.) (*Life Member*)	Chamba.
Biddulph, Lieut.-Col. S. F. (I.A.)	Neemuch.
Biggie, H. W.	Shillong.
Bignell, Capt. G. N.	Bombay.
Bignell, Capt. R. G., R.G.A.	Aden.
Bikanir, H. H. Col. the Maharaja Sir Gunga Singh of (G.C.S.I., G.C.I.E.) (*Life Member*)	Bikanir.
Billimoria, N. M.	Cutch-Bhuj.
Binning, D. B.	Bombay.
Binny, Capt. A. C. M.	*Europe.*
Birch, C. V.	*London.*
Birch, G.	Karachi.
Bird, Rev. A. F. R.	Nandyal, R. S.
Bird, B. H. (I.C.S.)	Rawalpindi.
Birkett, Lady	*Europe.*
Bishop, L.	Koomtai, P. O.
Bisset, Major E. (I.M.S.)	Jullundur.
Blackie, Capt. F. B.	Calcutta.
Blair, Capt. D. P. (R.A.M.C.)	*Europe.*
Blandy, Major R. (M.C.)	Bombay.
Blanford, H. R. (I.F.S.)	*England.*
Blathwayt, C. H. (I.C.S.)	*London.*
Blatter, Rev. E., S.J.	Bombay.
Bloech, E. O.	Rangoon.
Blunt, H. R.	Srinagar.
Boag, G. T. (I.C.S.)	Madras.
Boag, Capt. J. H. (M.C., R.A.M.C.)	Jhansi, U. P
Boalth, V. H.	Lahore.
Bodding, Rev. P. O.	Dumka.
Boles, Capt. D. C.	*Europe.*
Bolitho, Capt. E. W. (R.F.A.)	Bombay.
Bolster, R. C. (I.C.S.)	Delhi.
Bombay Government, The Chief Secretary, Separate Department	Bombay.
Bombay Veterinary College, The Principal	Bombay.
Bomford, Capt. T. L. (I.M.S.)	Calcutta.
Booth, Capt. C. H. B. (R.A.M.C.)	Bombay.
Boothby, Lt. R. F.	*England.*

Botham, A. W. (I.C.S., C.I.E.)	Shillong.
Bowen, Lt.-Col. A. W. N. (R.A.M.C.)	Ahmednagar.
Bowen, J. C. G.	Bombay.
Bowen, Major J. P. (R.E.)	Bombay.
Boxwell, F.	*Europe.*
Boyd, Major J. E. M. (R.A.M.C.)	*Europe.*
Bracken, G. T. H. (I.C.S.)	Coconada.
Bradfield, Major E. W. C. (I.M.S.)	*London.*
Bradley, J. W.	Bessein, Burma.
Bradshaw, J. P.	Bombay.
Braham, N. C.	Ban Nar Raheng.
Bramley, Major P. B. (I.A.R.)	Busra.
Branford, R.	Hissar.
Brassey, Major L. P. (I.M.S.)	*Europe.*
Breese, Wing Commander Charles (R.A.F.)	Simla.
Brent, H. A. W.	*Europe.*
Breslauer, B.	Bombay.
Bridgeman, Lt.-Col., the Hon. H. G. O.	*Europe.*
Brierley, Major W. E. (I.M.S., F.R.C.S.)	Bombay.
Bringentoff, Ernest A.	Esthonia.
Bristow, C. H. (I.C.S.)	Jalgaon.
Brodie, N. S. (I.C.S.)	*Europe.*
Brodrick, Capt. W. L. C.	Bangalore.
Brook, Carlton P.	Singapore.
Brook-Fox, E.	Poona.
Brooke, A. F.	*Europe.*
Brooke, Capt. A. S.	*Europe.*
Brooke, R. H.	Bombay.
Brooke-Smith, Lt.-Col. H.	Bombay.
Brooker, J. Gorton	Mirpurkhas.
Brooks, Major Allen (D.S.O.)	Canada.
Broucke, P.	Bagaha, P. O.
Broughton, Lt.-Col. T. D. (R.E., A.C.R.E.)	Nilgiris.
Brown, A. G.	Mal P. O.
Brown, C. J.	Lucknow.
Brown, Capt. D. G.	*London.*
Brown, Goroge.	Ceylon.
Brown, Lt.-Col. H. R. (I.M.S.)	Poona.
Brown, Capt. L. N. (I.C.S.)	Basra.
Brown, Prof. R. S. C. (B.S.C.)	Poona.
Browne, Major C. H.	Madras.
Browne, D. R. H.	P. Gulf.
Browne, E. G.	Fatehgarh, U. P.
Browning, Lt. C. S.	*Europe.*
Brunlees, Capt. L. H.	Mesopotamia.
Buckwell, B. E.	Rangoon.
Budden, Major J. A.	*Europe.*
Bulkley, W. W.	*England.*
Bullock, Capt. H. (I.A.)	Bombay.

Burd, Major E. (I.A.)	Shwebo, Burma.
Burder, H. C. (*Life Member*)	*Europe.*
Burke, E. P.	Dilburgarh.
Burke, Major R. C.	Kathiawar.
Burkill, I. H. (M.A.)	Singapore.
Burma Educational Syndicate, The Registrar	Rangoon.
Burma Forest School, The Director	Pyinmana, U. B.
Burn, J. G. (I.C.S.)	*Europe.*
Burnett, Prof. K.	*Europe.*
Burns, C. L.	Bombay.
Burton, Brig.-Genl. R. G.	*Europe.*
Burton, Lt.-Col. Richard W.	Bareilly, U. P.
Bury, Lt.-Col. Charles H.	*Europe.*
Busher, R. C.	Naini Tal.
Bute, The Most Hon'ble Marquis of (*Life Member*).	*Europe.*
Butler, A. L.	*Europe.*
Butler, E. W.	Matelli, P. O.
Butler, F. G. (I.C.S.)	Vizag.
Butler, Lt.-Col. H. M.	*Europe.*
Butler, Lt. S. G. (I.A.R.O.)	Shillong.
Byculla Club, The Hony. Secretary	Bombay.
Byrne, Major E. G. J.	Nowshera.

Caccia, Major A. M. (*Life Member*)	*Europe.*
Cadell, Hon'ble Mr. P. R. (I.C.S., C.I.E.)	Bombay.
Calcutta, Hony. Secretary, Zoological Gardens	Calcutta.
Caldwell, John	Calcutta.
Cambridge University Museum of Zoology, The Superintendent	*Europe.*
Cameron, D.	*Europe.*
Cameron, I. M.	Rajabhatkhawa
Cameron, Thos. H.	Kottayam.
Campbell, A. N.	Bombay.
Campbell, A. S.	Surat.
Campbell, Major G. C.	*Europe.*
Campbell, R. G.	*Europe.*
Campbell, Major T. A.	*Europe.*
Campbell, W. E. M. (I.C.S.)	Aligarh.
Canning College, The Professor of Biology	Lucknow.
Canning, Fred. (I.F.S.)	Naini Tal.
Capper, Lt.-Col. A. Stewart (D.S.O.)	Guna, C.I
Capper, Brigadier-Genl. W.	*Europe.*
Carmichael, The Hon'ble Sir G. (I.C.S., K.C.S.I.)	*England*
Carmichael, Lord (G.C.I.E., K.C.M.G.)	*Europe.*
Carmichael Medical College, The Principal	Calcutta.
Carter, Major H. St. M.	Simla.
Carter Lt.-Col. J. F. C. (I.A.)	*Europe.*
Carson, A. de C.	Kandy.

Casling, Dr. P. V. (I.M.D., D.G.M.C.)	Peshawar.
Cassamali Jairajbhoy Peerbhoy (*Life Member*)	Bombay.
Cassell, R. H.	Moniarah.
Cater, A. N. L. (I.C.S.)	Delhi.
Cattell, J. G.	*Europe.*
Cavanagh, B. F.	*Europe.*
Cave, W. A.	*Europe.*
Central India Agency Office, The Residency	Indore, C. I.
Central Research Institute, The Director	Kasauli, Punjab.
Central College, The Principal	Bangalore.
Chamier, Capt. R. O.	Ambala.
Champion, H. G. (I.F.S.)	Almora, U. P.
Channer, Major B. G.	Bombay.
Chanter, E. D.	Delhi.
Chapple, E.	Rangoon.
Chaston, Chas. S.	Calcutta.
Chatfield, H. S. (B.A., Bar.-at-Law)	Bombay.
Chaudhuri, B. L. (B.A., B.SC.)	Calcutta.
Cheema, Ganda Sing (M.S.C.)	Lahore.
Cheesman, Major R. E.	Baghdad.
Cheyne, G. C.	*England.*
Christopher, S. A. (Bar.-at-Law)	Rangoon.
Clark, A. J. (I.C.S.)	*Europe.*
Clarke, A. M.	Bombay.
Clarke, L. O. (I.C.S.) (*Life Member*)	Imphal, Assam.
Clayton, Major E. F.	*Europe.*
Clayton, F.	Patna.
Clerk, F. V.	Htawgan,U.Burma
Clifford, M. W. (I.F.S.)	Naini Tal.
Clifford, Lt.-Col. R.	*London.*
Clift, F. A.	Taungy.
Clogstoun, H. S. (R.F.C.)	*Europe.*
Club of Western India, Poona, The Hon'ble Secy.	Poona.
Clutterbuck, P. H. (I.F.S., F.Z.S., C.I.E.)	Dehra Dun.
Coates, C. F.	*Europe.*
Coates, Major V.	Jhansi.
Coats, Capt. D. H. (R.A.M.C.)	Simla.
Cochin, The Diwan of	Trichoor.
Cochrane, R. A.	Mogok.
Cockburn, E. D.	*Europe.*
Coen, W. W.	Hubli, S. M. Ry.
Coghill, Lt.-Col. N. S. (I.A.)	Palanpur.
Coggan, H. D.	Kamptee, C. P.
Coggin-Brown, John (M.SC., F.G.S.)	*Europe.*
Coimbatore, Librarian, Agricultural College and Research Institute	Coimbatore.
Colam, H. N.	*Europe.*
Coldstream, J. (I.C.S.)	Delhi.

Coldstream, Major J. C. (I.A.)	Simla.
Collins, M. V. H.	*Europe.*
Colombo Museum, The Librarian	Colombo.
Coltart, Dr. H. N. (*Life Member*)	*Europe.*
Colthurst, Dr. Ida	Calcutta.
Colvin, Major E. J. D. (I.A.)	Indore.
Colvin, Miss B.	*London.*
Comber, Edward (F.Z.S.)	Bombay.
Conder, J. M. (I.C.S.)	Bassein.
Condon, E. C. H. (M.A.I., A.M.I.C.E., M.A.)	Bombay.
Congreve, C. R. T.	Coimbatore.
Conley, Andrew	Jamaica.
Connor, Lt.-Col. F. P. (F.R.C.S., I.M.S., D.S.O.)	Calcutta.
Conservator of Forests, N. C. Division	Jubbulpore, C. P.
Cooch Behar, Maharaj Kumar Victor N. Narayan.	Cooch Behar.
Coode, J. M. (*Life Member*)	*Europe.*
Cook, Chas.	*Europe.*
Cook, J. Pemberton	Africa.
Cooke, E. Bernard	Bombay.
Cooper, Capt. D. G. (I.M.S.)	Bombay.
Cooper, G. E. R.	Almora.
Cooper, H. L.	Calcutta.
Cooper, H. R. (B.SC., F.C.S.)	Cinnamara, P. O.
Cooper, T.	Mhow.
Copley, H. B.	Kotah.
Copley, Hugh	Nagpur.
Corbett, G. L. (I.C.S.)	Saugor, C. P.
Corbett, R. H.	Papun, Burma.
Cosens, Major F. R.	Delhi.
Cosens, Lieut. G. P.	Sudan.
Courthope, E. A. (I.F.S.)	*Europe.*
Covernton, S. H. (I.C.S.)	*London.*
Cowie, Rev. A. G. G. (*Life Member*)	Rawalpindi.
Cox, C. E. C. (F.Z.S., I.F.S.)	Dehra Dun, U. P.
Cox, H. R.	Nowshera.
Cox, Lt.-Genl. Sir Percy Z. (G.C.I.E., K.C.S.I., K.C.M.G., F.Z.S., F.R.G.S., K.C.I.E.)	Baghdad.
Craw, H. H. (*Life Member*) (I.C.S.)	Rangoon.
Crawford, F. L.	Raipur.
Crawford, Leslie	Bombay.
Crawford, W. M. (I.C.S.)	Belfast.
Crerar, J. (I.C.S., C.I.E.)	Bombay.
Crompton, Capt. J.	Bannu.
Cross, R. G.	*Europe.*
Crosthwaite, B. M.	*Europe.*
Crosthwaite, Major C. G. (I.A.)	*Europe.*
Cruickshank, Major J. E.	Dehra Dun.
Cubitt, G. E. S. (I.F.S.)	Kuala Lumpur.

Cuffe, Lady C. T. W.	Maymyo.
Culbertson, J. M. S. (A.M.I.C.E.)	Karachi.
Cull, B. N.	Calcutta.
Cunningham, Lt.-Col. A. H. (R.E.)	Roorkee.
Cunningham, C. F.	Bombay.
Curran, Capt. W. J.	*Europe.*
Currey, E. S.	*Europe.*
Currie, A. J.	Shiraz.
Currie, M. M. L. (I.C.S.)	Gujaranwala.
Currimbhoy Ebrahim, Sir, Bart.	Bombay.
Curror, John	Karimpore.
Curry, J. C.	*Europe.*
Cursetji, Khan Bahadur C. M. (*Life Member*)	Bombay.
Cutch, H. H. Sir Shri Kengurji Sawai Bahadoor, the Maharao Saheb of (G.C.I.E., G.C.S.I.) (*Life Member*)	Bhuj, Cutch.
Cuvelier, E. D. A.	*Europe.*
D'Adhemar, Raymond W.	Bandikui.
D'Almeida, J. F. K. (B.A., B.SC.)	Bandra.
Dacca Museum, Superintendent, Natural History Section	Dacca.
Daintith, E. (I.A.R.)	Ahmednagar.
Daly, Col. Sir Hugh (K.C.S.I., C.S.I., K.C.I.E.)	*Europe.*
Damania, Govind P.	Versowa.
Daniel, Capt. C. J.	*Europe.*
Danson, J. W. W.	*Europe.*
Darjeeling Gymkhana Club, The Secretary	Darjeeling.
Darjeeling, The Vice-President, Natural History Museum	Darjeeling.
Dart, G. Wesché	Bombay.
Datia, H. H. the Maharaja Lokendra Govind Singh, Bahadur	Datia, C. I.
Datta, Dr. D. N. P. (M.D.)	Hoshiarpur.
Daukes, Major C. T.	Bombay.
Davey, G. H.	Alleppey.
Davidson, H. M. M.	Behali P.O., Assam.
Davidson, J.	*Europe.*
Davidson, Lt.-Col. J. (I.M.S., D.S.O.) (*Life Member*)	Bombay.
Davies, W.	Poona.
Davis, G. (I.C.S.)	Bombay.
Davison, A.	Jubbalpore, C. P.
Dawes, Lt.-Col. C. D. (I.M.S.)	Bombay.
Dawkins, C. G. E. (I.F.S.)	Katha, U. Burma.
Dawson, H.	Chittoor.
Dawson, W. G. (F.E.S.)	*Europe.*
Dawson, W. H. (I.C.S.) (*Life Member*)	*Europe.*
D'Cruz, A. M.	Bombay.

Deakin, Mrs. M. E.	Calcutta.
Dean, Edwoin	Peshawar.
Deane, N. B.	Calcutta.
De Carteret, St. G.	Kheri, U. P.
De Gruyther, T.	Lucknow.
De Rhe-Philipe, G. W. V. (F.E.S.)	*Europe.*
De Zwart, W.	Medan, Sumatra.
Delany, M. F.	Bombay.
Delmege, C. H. (R.E.)	Mesopotamia.
Delmé-Radcliffe, Major A.	Bombay.
Delmé Radcliffe, Lt.-Col. H. (F.Z.S., F.R.G.S., M.B.O.U.)	*Europe.*
Deputy Director of Agriculture, Burma	Mandalay.
Deshmukh, C. D. (I.C.S.)	Amraoti.
Dew, The Hon'ble Lt.-Col. A. B. (C.S.I., C.I.E.)	Quetta.
Dewar, D. (I.C.S.)	Ranchi.
Dewes, Lt.-Col. F. J. (I.M.S.)	Rangoon.
Dhar, H. H. The Raja of (K.C.S.I.) (*Life Member*)	Dhar, C. I.
Dharamdas Tribhuvandas Varjivandas	Bombay.
Dholpur State, The Maharaj Rana Udaibhan Saheb Bahadur, Dholpur	Rajputana.
Dhrangadhra, H. H. Ghanshyam Sinhji	Kathiawar.
Dhunjibhoy Bomanji (*Life Member*)	Bombay.
Dibell, Miss Mabel E.	Madras.
Dickson, Brigadier-General E.	*Europe.*
Dickson, Major H. R. P. (C.I.E.)	Bahrain.
Director of Agriculture, Bombay	Poona.
Director of Agriculture, F. M. S.	Kuala Lumpur.
Director of Agriculture, Mesopotamia	Mesopotamia.
Director of Industry, Bombay	Bombay.
Dixit, D. L. (B.A.)	Poona.
Dobbs, J. G.	Raichur.
Dobbs, W. E. J. (I.C.S.)	Simla.
Dodgson, Major R. C. (R.F.A.)	*Europe.*
Dods, Capt. E. R. S. (I.A.)	Bombay.
Dods, W. K.	Calcutta.
Donald, C. H.	Dharmsala.
Donaldson, A. E.	Rangoon.
Donaldson, R.	Ajmer.
Donovan, Lt.-Col. C. (I.M.S.)	*Europe.*
Douglas, Col. A. P. (R.A.)	Simla.
Douglas, Wm.	Suffry, P. O.
Dover, C.	Calcutta.
Dow, H. (I.C.S.)	*Europe.*
Dow Hill Training College, The Principal	Kurseong.
Downing, A. K. Weld	Coonoor, Nilgiris.
Dowson, E. C.	Ceylon.

Dracott, C. H.	Jamshedpur.
Drake-Brockman, Major D. H.	Lansdowne, Garhwal, U. P.
Drake-Brockman, D. L. (I.C.S.)	Jodhpur, U. P.
Drake-Brockman, Lt.-Col. H. E. (I.M.S., F.Z.S.) (*Life Member*)	*Europe.*
Drummond, Capt. J. G. P.	Manzai.
Drummond, J. R. (B.A., F.L.S.)	*Europe.*
Drummond-Hay, H. M.	Ceylon.
Drury, B. W.	Chanda, C. P.
Drury, J. (M.A.)	Pachgani.
DuBoulay, The Hon'ble Sir James (I.C.S., K.C.I.E.).	Simla.
Dubash, K. D.	Bombay.
Duckworth, G. P.	Poona.
Duff, A. C. (I.C.S.)	*Europe.*
Duke, A. H.	Siam.
Duke, J. A.	Seoni-Chappara.
Dumayne, Sir Frederick	*Europe.*
Dunbar-Brander, A. A. (I.F.S., O.B.E.)	Khandwa, C. P.
Dunkley, E. J.	Yenangyonng.
Dunn, C. W. (I.C.S.)	Maymyo.
Dunn, Col. H. N. (A.M.S.)	Bangalore Brigade
Dunsterville, Col. K. S. (R.A.)	*Europe.*
Duxbury, B. H.	Bombay.
Duxbury, Major C. D. (*Life Member*)	Simla.
Dwane, E. H.	*Europe.*
Dwane, F. C.	Ballarpur.
Dwane, H. M.	Madras.
Dwane, Lt.-Col. J. W.	*Europe.*
Dyson, Col. T. E. (I.M.S.)	*Europe.*
Ebden, Capt. J. W.	Mesopotamia.
Eccles, P. (I.C.S.)	Bombay.
Economic Botanist to Government, U. P.	Cawnpore.
Edge, Mrs. R. C.	*England.*
Edwards, Capt. F. H.	Bombay.
Effendi, Prince A. R. Shahzada	Kothi.
Elgee, Lt.-Col. J. W. L.	*Europe.*
Elliott, A. (C.I.E.)	*Europe.*
Elliott, J.	*Europe.*
Elliott, R. E. A. (I.C.S.)	Bijapur.
Ellis, R. H. (I.C.S.)	Mangalore.
Ellis, S. F.	*England.*
Elmore, A. E.	Tharrawaddy.
Elwes, H. J. (F.R.S.)	*Europe.*
Emblen, H.	*Europe.*
English, E. E.	*Europe.*
Erb, E.	Bombay.

Erskine, J.	Nilgiri.
Evans, Geoffrey (B.A., C.I.E.)	*Europe.*
Evans, Col. G. H. (I.C.V.D., F.L.S., C.I.E.)	Rangoon.
Evans, R., Dn. B.	Baghdad.
Evans, T. M.	Bombay.
Evans, Capt. J. W. D.	Meerut.
Evans, Lt.-Col. W. H. (R.E.)	Rangoon.
Evershed, John	Kodaikanal.
Ewing Christian College, The Professor, Department of Biology	Allahabad.

Fairbank, Rev. H.	Ahmednagar.
Faith, N. W.	Bombay.
Farley, T.	Darrang.
Farr, E. T. C.	Quilon.
Farrell, R. C. (I.F.S.)	Hyderabad, Dn.
Farrington, Sir H. A., Bart. (I.F.S.)	Darjeeling.
Fawcett, E. B.	*Europe.*
Fawcus, L. R. (I.C.S.)	Calcutta.
Fayrer, Lt.-Col. F. D. S. (I.M.S.)	Bombay.
Fell, Hon'ble Sir Godfrey (C.I.E., I.C.S.)	Delhi.
Fellowes, Kyrle	*Europe.*
Fellowes-Manson, Lt. C. E.	Mandalay.
Fenton, Col. L. L. (I.A.)	*Europe.*
Fenton, Capt. L. S. (I.A.)	Mesopotamia.
Fernandes, B. A.	Bandra.
Fernandes, J.	Nagpur.
Ferrar, Major M. L. (I.A., O.B.E.)	Lahore.
Field, Frank	Gonda, U. P.
Field, Capt. F. M. S.	Calcutta.
Field, G. G.	Port Blair.
Field, W. P.	Jalpaiguri.
Finlay, Sir C. Kirkman	*Europe.*
Firth, Lt.-Col. R. A.	Nowshera.
Fischer, C. E. C. (I.F.S.)	Coimbatore.
Fitz-Gerald, Major A.	Bombay.
Fitz-Gibbon, Lt. F. (R.A.)	Africa.
Fitzpatrick, Capt. G. V.	Mesopotamia.
Fleming, Lt.-Col. A. M. (I.M.S.)	Bombay.
Fleming, E. W.	Myitnge.
Fletcher, Capt. A. B.	M. E. F.
Fletcher, T. Bainbrigge (F.E.S.)	Pusa.
Fletcher, G. G.	Bombay.
Florence, James	Athestone.
Flower, Capt. S. S.	*Egypt.*
Flynn, A. A. (C.M.Z.S.)	Karachi.
Forbes, Alister	Bombay.
Forest Botanist, Forest Research Institute	Dehra Dun.

Forsham, R.	Bombay.
Forster, T. W. (B.F.S.)	Mansi.
Forsyth, Dr. Wm.	*Europe.*
Forsyth, Dr. C. E.	Borjuli, P. O.
Foster, O. B.	*Europe.*
Foster, R. Guy	Sallebile, P. O.
Foster, Major R. T.	*Europe.*
Foulkes, R.	Madura.
Foulkes, Lt.-Col. T. H. (I.M.S.) (*Life Member*)	Aden.
Fountaine, Miss M. (F.E.S.)	California.
Fowke, Philip F.	Nuwera Eliya.
Fowler, Mrs. C.	*England.*
Francis, Lt. H. F. (R.G.A.)	Rangoon.
Francis, Capt. R. F.	Jullundur.
Fraser, Duncan	Bombay.
Fraser, D. de M. S.	Bombay.
Fraser, Major F. C. (I.M.S., M.D., F.L.E.S.)	Mhow
Fraser, J. S.	Madras.
Fraser, The Hon'ble Sir Stuart (I.C.S., C.I.E., K.C.S.I.)	*Europe.*
Fraser, Major S. G. G.	Muttra.
Fraser, W. S. (O. B.E.)	Ajmer, Rajputana.
Frei, Max	Bombay.
French, H. A. L.	Karachi.
Frenchman, D. P. (B.SC.)	Bombay.
Frere, Major A. G.	*Europe.*
Friedlander, F. L.	Rangoon.
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Lunawada, Maharaj Kumar Ranjit Singh of	Lunawada.
Lunham, Lt.-Col. J. L. (I.M.S.)	Bombay.
Lyall, J. H. (I.F.S.)	Nani Tal.
Lyall, Major R. A.	Ajmer.
Lydiard, G. Gordon	Sitamahri.
Lynch, C. E.	*Europe.*
Lynch-Blosse, C. E.	Bombay.
Lynch-Blosse, H. R. (I.C.S.)	Delhi.

Macaulay, F. G. A.	Madras.
MacCaw, V. H.	Calcutta.
Macdonald, A. St. J. (I.A.R.O.)	Mesopotamia.

Macdonald, K. C.	*Europe.*
MacDonald, Lt. A. B. (R.F.A.)	Belgaum.
MacEwen, Lt.-Col. D. L.	*Europe.*
MacFadden, R. R.	Rairangpore.
Macgregor, Duncan	Aden.
MacGregor, Capt. R. F. D. (I.M.S.)	Bombay.
MacIlvaine, Miss Anne	*New Jersey, U.S.A.*
Macintyre, Capt. D.	*Europe.*
Mackay, C. J.	Calcutta.
Mackenna, J. (C.I.E., I.C.S.)	Rangoon.
Mackenzie, Allen	Dooars.
Mackenzie, Capt. E. A. H.	*Europe.*
Mackenzie, G. H. L.	Calcutta.
Mackenzie, J. M. D. (I.F.S.)	Rangoon.
Mackenzie, Major L. H. L. (I.M.S.)	Bombay.
Mackenzie, J. M.	Surdah.
Mackenzie, M. M.	Saran, Bihar.
Mackie, A. W. W. (I.C.S.)	*Europe.*
Mackinlay, Lt.-Col. Chas.	*Europe.*
Macklin, A. S. R. (I.C.S.)	Larkana, Sind.
Mackwood, F. M.	*London.*
Mackwood, F. E.	Colombo.
MacLachlan, R. B.	Poona.
MacLachlan, Capt. D. (I.A.R.O.)	Karachi.
Macleod, The Hon'ble Sir Norman	Bombay.
Macleod, R. D. (I.C.S.)	Fatehpūr.
MacMichael, N. (I.C.S.)	Adyar.
Macnaghten, The Hon'ble Mr. H. P. W. (M.A.)	Bombay.
Macnaghten, N. D.	Cairo, Egypt.
Macnee, E. A.	Nagpur.
Maconochie, The Hon'ble Mr. E. (C.S.I., I.C.S.)	Rajkot.
Macphail, G.	*Europe.*
Macpherson, R. E.	Mirzapur.
Mactavish, Capt. A.	*Europe.*
Madan, F. R.	Kurnool.
Maddock, Lt..-Col. E. C. G. (I.M.S.)	Ahmednagar.
Madras Forest College, The Principal	Coimbatore.
Madras, The Librarian, Govt. Central Museum	Madras.
Madras, The Principal, Presidency College	Madras.
Madras, The Professor of Zoology, Christian College.	Madras.
Mahaluxmiwalla, C. D.	Bombay.
Mahomedbhoy Currimbhoy Ebrahim	Bombay.
Mahon, E. L.	Pollibetta.
Main, T. F. (B.SC.)	Mirpurkhas.
Major, Lt.-Col. F. F.	Bombay.
Makeig-Jones, J. (I.C.S.)	Dera-Ismail-Khan.
Malik, Sahib Abdul Haq	Jullundur.
Malony, Capt. J. B. de W. (I.M.S.)	Sehore.

Maltby, Capt. C. M. (I.A.)	Bombay.
Manavadar, Khan Shree Fatehdinkhan, Chief of (*Life Member*)	Manavadar.
Mandlik, Narayan V. (*Life Member*)	Bombay.
Manekjee, Manek M.	Tavoy.
Mann, Dr. H. H.	Poona.
Mann, T. H.	*Europe.*
Marjoribanks, Lt.-Col. J. L. (I.M.S.)	Bombay.
Marjoribanks, N. E. (I.C.S.)	Madras.
Marlow, T.	Tharawadi.
Marrs, R.	Bombay.
Marryatt, N.	Bombay.
Marshall, Major A. (D.S.O.)	Quetta.
Marshall, A. H.	Punjab.
Marshall, Arch. McL. (*Life Member*)	*Europe.*
Marshall, A. W.	Karachi.
Marshall, Mrs. H. A.	Travancore.
Marshall, Dr. H. H. (L.R.C.S.)	Rangoon.
Marshall, J. McL. (*Life Member*)	*Europe.*
Marshall, Lt.-Col. T. E. (R.A.)	*Europe.*
Martin, A. ff.	Ellappatty, P. O.
Martin, Capt. C. De. C. (I.M.S.)	Bombay.
Martin, Capt. E. H. de C.	Benares.
Martin, Col. Gerald (*Life Member*)	*Europe.*
Martin, F. A.	*Europe.*
Martin, Major J.	Bombay.
Martin, S. J.	Binsar.
Martindell, H. E. W.	Rangoon.
Mason, Major L. (M.C., I.F.S.)	Saugor.
Massy, Major W. J.	Burma.
Matthews, W. H.	Darjeeling.
Maund, Lt. J. A. H.	Bombay.
Maung, Po Bye (K.S.M. & F.R.C.I.)	Myaung-Mya.
Mawson, Mrs. G. T.	Thana.
Maxwell, Lt.-Col. J. (R.F.A.)	*Europe.*
Maxwell, R. M. (I.C.S.)	Bombay.
Maxwell, Major W. F. (R.E.)	Bombay.
Mayes, W.	Rangoon.
Mayne, Lt.-Col. H. B. (R.G.A.)	Bombay.
Mayo, H. T.	Karachi.
Mayo College, The Principal	Ajmer.
Mazagonwalla, K. B. (B.A.)	Bombay.
McArthur, Lt. A. G. (I.A.R.O.)	Rosecandy.
McCann, C.	Bombay.
McCleverty, Capt. G. M. (M.C.)	Bombay.
McConaghy, Major C. B. (I.M.S.)	Sehore, C. I.
McConnell, Lt. R.	Bombay.
McCormack, Dr. H.	Peermade.

McCudden, Capt. J. H.	Lahore.
McDonald, Capt. E. J. C. (I.M.S.)	Assam.
McDonough, Lt. A. D.	Cawnpore.
McGlashan, John (C.E.)	Calcutta.
McIlwrick, L.	Gokak Falls.
McIntosh, Alex. (C.E.)	Trichinopoly.
McIver, C. D.	Satara.
McLaughlen, Major H. D.	Indore.
McLead, H. T. (A.M.I.C.E., F.R.M.S.)	Guntakal.
McLeod, M. C.	Calcutta.
McLellan, Capt. J. S.	Poona.
McMahon, Sir Henry (G.C.V.O., K.C.I.E., C.S.I.)	*Europe.*
McNeale, J. H.	Saugor, C. P.
McNeill, J. (I.C.S.)	*Europe.*
McRae, Wm.	Coimbatore.
Mead, The Hon'ble Mr. P. J. (C.I.E., I.C.S.)	Bombay.
Mears, Lt.-Col. A. (I.A.)	*Europe.*
Meaton, E. G.	Oorgaum.
Meek, Dr. D.	*Europe.*
Mehta, Dr. M. V. (M.R.C.P., L.M. & S.)	Bombay.
Meinertzhagen, Lt.-Col. R.	*Europe.*
Menezes, J. Hector	Goa.
Menon, K. G.	Trichoor, Cochin.
Mercer, David	*Europe.*
Meredith, H. R. (I.C.S.)	Khunti.
Merrikin, M. S.	Burma.
Mess Secretary, R. A. Mess	Bombay.
Mess Secretary, R. A. Mess	Cambellpore.
Mess President, Leicestershire Regiment.	
Mess President, 1st Connaught Rangers.	
Mess President, The 1st Border Regiment.	
Mess President, 1st Battalion, The Royal Scots.	
Mess Secretary, 2nd Q. V. O. Sappers and Miners, Bangalore.	
Mess Secretary, 5th Ammunition Column, R. F. A.	
Mess President, 1/6th Jat. Light Infantry.	
Mess President, 7th Hussars.	
Mess President, 2/8th Gurkha Rifles.	
Mess President, XIth K. E. O. Lancers.	
Mess Secretary, 13th Rajputs.	
Mess Secretary, 18th Infantry.	
Mess Secretary, 41st Dogras.	
Mess President, 42nd Deoli Regiment.	
Mess President, 44th Merwara Infantry.	
Mess Secretary, 45th Rattray's Sikhs.	
Mess President, 46th Punjabis.	
Mess President, 52nd Sikhs.	
Mess Secretary, 58th Rifles.	

Mess Secretary, 59th Scinde Rifles.	
Mess President, 62nd Punjabis.	
Mess President, 64th Pioneers.	
Mess Secretary, 87th Punjabis.	
Mess President, 90th Punjabis.	
Mess President, Officers Mess, K. O. Y. Lt. Infantry.	
Mess Secretary, 1st K. S. Lt. Infantry	Aden.
Mess President, 94th Russell's Infantry.	
Mess President, The 101st Grenadiers.	
Mess President, 103rd Mahratta L. Infantry.	
Mess Secretary, 109th Infantry.	
Mess President, 110th Light Infantry.	
Mess President, 117th Marathas.	
Mess President, 122nd Rajputana Infantry.	
Mess President. Royal Artillery	Lucknow.
Messent, P. G. (C.I.E., C.E.)	*Europe.*
Milburne, Wm.	Calcutta.
Millard, Miss Hallen.	*London.*
Millard, W. S. (F.Z.S.) (*Life Member*)	*England.*
Miller, A. C.	Poona.
Miller, Lt. J. G.	Kandri.
Miller, W. A. H. (I.F.S.)	Nasik.
Millett, Capt. G. P.	*Europe.*
Mills, Major J. D. (*Life Member*)	*Europe.*
Mills, J. P. (I.C.S.)	Naga Hills.
Milner, C. E.	Rangoon.
Milroy, A. J. W.	Gauhati.
Miraj, Shrimant Gungadhar Rao Ganesh *alias* Babasaheb Patwardhan, Chief of (*Life Member*)	Miraj.
Mitchell, F. J.	*Europe.*
Mitchell, H. H. G.	Madras.
Mitchell, Capt. R. St. J. (R.E.)	Bombay.
Mitra, M. (M.SC.)	Agra.
Mole, R. R. (C.M.Z.S.)	*Europe.*
Molesworth, Major A. L. M.	Quetta.
Montagnon, D. J.	Assam.
Monte, Dr. D. A. de (L.M. & S.)	Bandra.
Monteath, G. (I.C.S.) (*Life Member*)	Jalgaon.
Monteath, J. (I.C.S.)	Bombay.
Montgomerie, A. (I.C.S.)	Belgaum.
Montgomerie, H. (I.C.S.)	Tando, Hyderabad.
Montmorency, G. F. de (I.C.S.)	Delhi.
Moolla, M. E.	Rangoon.
Moore, H. B.	Bombay.
Moore, J.	Madras.
Moore, T. D.	Bombay.

Moore, W. G.	Maymyo.
Morrell, A. C.	Travancore.
Morris, Chas. F.	Bombay.
Morris, Lt.-Col. A. H. (R.A.M.C.)	*Europe.*
Morris, A. P. (B.SC.)	Insein.
Morris, Lt.-Col. D. O. (*Life Member*)	*Europe.*
Morris, R. C.	Attikan P. O.
Morrison, H. W.	Badlipar.
Moss, Capt. E. de V.	Ali Masjid.
Mosse, Major A. H. E. (I.A.) (*Life Member*)	Bombay.
Motilal Vallabhji	Bombay.
Moule, Major H. E.	*Europe.*
Moulton, Major J. C.	Singapore.
Mowbray, Capt. G. B. De	*Europe.*
Moylan, W. M.	Jamtee.
Moynan, Dr. R. N. O.	Bilaspur, C. P.
Mudhol, Shrimant Malojirao Raje Ghorpade, Chief of	Mudhol, S. M. C.
Muir Central College, The Principal	Allahabad.
Muir, G. B. F. (I.C.S.)	Basti, U. P.
Muirhead, Lt. J. M.	Deolali.
Mullan, J. P. (M.A., F.L.S., F.Z.S.)	Bombay.
Mulroney, J. T.	Siliguri.
Mundy, N. S.	Silchar, Cachar.
Munn, Capt. Leonard (R.E.)	Delhi.
Munns, F. A. C.	Bihar.
Murdoch, F.	Jalpaiguri.
Murland, Major H. F. (*Life Member*)	*Europe.*
Murphy, E. J.	Rangoon.
Murray, Capt. A. D.	Quetta.
Murray, Major J. H. (I.M.S., C.I.E.)	Bombay.
Musgrave, Brig.-Genl. A. D. (R.F.A.)	Mesopotamia.
Mysore, The Director of Agriculture	Bangalore.
Mysore, The Superintendent, Mysore Government Museum	Bangalore.
Mysore, H. H. the Maharaja Krishna Raj Woodayar Bahadoor (G.C.S.I.) (*Life Member*)	Mysore.

Nagpur, Central Museum, The Curator	Nagpur, C. P.
Nair, (Hon.) A. Narayanan, (B.A.)	Bedla, near Udaipur.
Namjoshi, V. K.	Cambay.
Nand Kumar Twari (B.SC.)	Benares.
Nangle, Lt.-Col. M. C.	Quetta.
Napier, A. G. F. (M.SC., A.M.I.C.E.)	Rangoon.
Napier, Ford G. S.	Vandiperiyar, U. P.

Naraenji Dwarkadas (*Life Member*)	Bombay.
Narrotumdas Morarji Goculdass (*Life Member*)	Bombay.
Nash, H. J.	Ajmere.
Nasrulla Khan, H. H. Nawab Major Mahomed	Bhopal, C. I.
Nawanagar, H. H. The Jam Saheb of Jamnagar.	Kathiawar.
Neale, Capt. W. G. (I.A.)	Bombay.
Needham, J. E. (C.B.E.)	Bombay.
Nevill, Capt. G. A.	Badlipara.
Nevill, Humphry	Gujranvalla.
Newcome, Lionel	Somwarpet P. O.
Newland, Major W. B. M. (I.M.S.)	Bombay.
Newman, E. G.	Bombay.
Nicholetts, Lt. W. A.	Assam.
Nicholls, Major W. A. (R.H.A.)	*Europe.*
Nicholson, K. G.	Bombay.
Nicolas, Mrs. E. H. A.	Barabanki.
Niederer, George	Bombay.
Nisbet, R. H.	*Europe.*
Nizam's College, The Librarian	Hyderabad, Deccan.
Norman, C.	Rangoon.
Norman, Capt. A. C.	Bombay.
Norman, Col. H. H. (R.A.M.C.)	Mesopotamia.
Norman, John B.	Champaran.
Norries, J. P.	Philadelphia, U. S. A.
Noyce, F. (I.C.S.)	Simla.
Nurse, Lt.-Col. C. G. (F.E.S.) (*Life Member*)	*Europe.*
Nuttall, W. M.	Dibrugarh.

Oakley, R. R.	*Europe.*
Oberholser, Harry C.	Washington, U.S.A.
O'Brien, Lt.-Col. Edward	Bhuj.
O'Brien, P.	Surat.
O'Brien, J. Riley	Bombay.
O'Callaghan, T. P. M.	Sadiya.
O'Connell, Dr. J. M.	*Europe.*
O'Connor, Dr. Francis W.	Assam.
O'Donel, H. V.	Hasimara.
O'Donnell, O.	*Europe.*
O'Hara, R. R.	Rangoon.
Ogilvie, A. W. (I.F.S.)	Prae, Siam.
Ogilvie, G. H. (I.F.S.) (*Life Member*)	*Europe.*
Ogilvy, Lt.-Col. D. (R.E.)	Bareilly, U. P.
Oldfield, Lt.-Col. G. E. B.	Dargai.
Oliver, A.W. L.	China.
Oliver, Col. H. D. (R.E., F.Z.S.) (*Life Member*)	*Europe.*
Oliver, Major D. G.	Bombay.

Ollenbach, O. C.	Dehra Dun, U. P.
Ormiston, W.	*Europe.*
Orr, Major H. M. C.	*Europe.*
Orr, J. P. (C.S.I., I.C.S., C.B.E.)	*Europe.*
Osborne, A. F.	Ramnad.
Osmaston, A. E. (I.F.S.)	*Europe.*
Osmaston, B. B. (I.F.S., C.I.E.)	Pachmari.
Ostrehan, Capt. M.	Imphal.
Ouseley, Mrs. W.	Dehra Dun.
Oxley, Lt.-Col. J. C. S. (I.M.S.)	Bombay.
Owen, W. C. Tudor (I.C.S.)	Palitana.

Page, A. J. (I.C.S.)	Nyaunglebin.
Page, W. T. (F.Z.S.)	*Europe.*
Paget, B. C. T.	*Europe.*
Palanpur, H. H. Capt. Nawab Saheb Taley Mahomed Khan	Palanpur.
Panchgani, Lady Superior St. Joseph's Convent	Panchgani.
Panday, Mrs. J. L.	Bombay.
Panna, H. H. the Maharaja Mohendra Yadvendra Singh Bahadur	Panna, C. I.
Parish, N. B.	Bombay.
Parker, H. (I.C.S.)	Homalin.
Parker, R. N. (I.F.S.)	*Europe.*
Parlett, L. M. (I.C.S.) (Retd.)	*Europe.*
Parr, Lt.-Col. H. O. (A.D.C.)	Meerut.
Parrington, Major J. W. (R.A., R.F.A.)	Simla.
Parsons, S. R. (I.F.S.)	Chhindwara, C. P.
Partridge, C. R.	Nagrakata P. O.
Pascoe, J. Harding	Nilgiris.
Pasteur Institute of India, The Director	Kasauli, Punjab.
Pasteur Institute, The Director	Rangoon.
Patel, P. D.	Bombay.
Patiala, H. H. the Maharaja of (*Life Member*)	Patiala.
Patna College, The Librarian	Bankipore.
Patuck, P. S. (I.C.S.)	Narsingpur.
Pawsey, C. R. (I.C.S.)	Assam.
Pears, S. E. (C.I.E., I.C.S.)	Khyber, Peshawar.
Pearson, Major G. H. A.	Jullundur.
Pearson, R. S. (I.F.S.)	Dehra Dun, U. P.
Pearson, Major W. B.	France.
Peck, N. F. (I.C.S.)	Bhagalpore.
Peebles, W. J. M.	Shahibag.
Peile, Lt.-Col. H. D. (I.M.S.)	*Europe.*
Peppe, Capt. F. H. (R.F.A.)	Nowshera.
Percival, A. P. (I.F.S.)	*Europe.*

Percival, G. S. P.	Ramnad.
Perry, J. J.	Burma.
Perry, Major S. (R.A.)	Bombay.
Pershouse, Major S.	*Europe.*
Peshawar, Municipal Committee, The Secretary	Peshawar.
Pestonji Jivanji (N.C.S.) (*Life Member*)	Hyderabad, Deccan.
Petit, Dhunjibhoy Bomanji (*Life Member*)	Bombay.
Petit, Jehangir Bomanji (*Life Member*)	Bombay.
Petit, Major G. (R.A.M.C.)	Bombay.
Petley, C. A.	Toungoo.
Phayre, Major R. B. (M.C.)	Quetta.
Phelps, Lt.-Col. M. P.	*Europe.*
Philip, C. L.	*Europe.*
Phillips, A. A. (I.S.R.)	*Europe.*
Phillips, C. A.	Calcutta.
Phillips, Major J. A. S. (I.M.S.)	Kohat.
Phillips, J. R.	Insein.
Phillips, W. W. A.	Ceylon.
Phipson, Major E. S. (I.M.S.)	Simla.
Phipson, H. M. (F.Z.S.) (*Life Member*)	*Europe.*
Phythian-Adams, Major E. G.	*Europe.*
Pinfod, E. S. (B.A.)	Calcutta.
Pipe, T. S.	Dharwar.
Pitman, Capt. C. R. S.	Egypt.
Pitt, W. H.	Madras.
Pogson, Capt. F. V.	*Europe.*
Pollard, Lt.-Col. A. E. St. V.	Bombay.
Poncins, Viscount Edmond de (*Life Member*)	*France.*
Ponsonby, W. G.	Secunderabad.
Pope, J. A. (I.C.S.)	Bombay.
Porbandar State, The Dewan	Porbandar.
Port Blair Settlement Reading Club	Port Blair.
Porter, 2nd-Lt. G. H.	Poona.
Pottinger, Capt. J. A.	Tank, N. W. F. P.
Pottinger, Lt.-Col. R. S.	Bombay.
Powell, J. E.	Herbertpore.
Powell, J. W.	Bombay.
Powell, W. S. (I.F.S.)	Rangoon.
Prall, Col. S. E. (I.M.S.)	*Europe.*
Pratap Singh, Lal Ram (B.A., LL.B.)	Dehra Dun.
Prendergast, H. H. L.	Arkonam.
Prendergast, Capt. N. H.	Miranshah.
Prentice, James	Cossipore.
Prescott, Major C. W. (I.A.)	Bannu.
Prescott, Major H. W. B. (R.A.M.C.)	Bombay.
Priestley, E. (D.S.P.)	Bijapur.
Priestley, Mrs W.	Bombay.

Primrose, Alex. M.	Assam.
Procter, Sir Henry E. (C. B. E.)	*Europe.*
Pudukkottai, State Museum, The Curator	Pudukkottai.
Pujari, Tribikram (B.A.)	Puri, Orissa.
Punjab Agricultural College, The Principal	Lyallpur.
Purkis, F. C. (B.F.S.)	Rangoon.
Purkis, H. Vernon	Kishtwar.

Quarry, P. S.	Dacca.
Quinlan, D. (M.R.C.V.S.)	Ranchi.
Quin, Lt.-Col. R. P. Wimyss	Dhond.

Rae, Major M. E. (*Life Member*)	Kohat.
Raikes, E. B.	*Europe.*
Raikes, Major L. T. (D.S.O., R.F.A.)	Belgaum.
Rajkot, H. H. Sir Lakhajiraj (K.C.I.E.)	Rajkot.
Rajkumar College, The Principal	Rajkot.
Rajkumar College, The Principal	Raipur.
Rake, B. C.	Prome, Burma.
Ralston, Lt.-Col. W. H. (D.S.O.)	Bombay.
Rane, K. R. (M.M. & S.P.)	Juvem, Bombay.
Rane, Y. K.	Juvem, Bombay.
Raper, J. C. D. (A.M.I.C.E., V.D.)	Lanowli.
Ravenshaw, Col. C. W. (*Life Member*)	*Europe.*
Rawalpindi Club, Ltd., The Secretary	Rawalpindi.
Readymoney, N. J.	Bombay.
Rector, St. Mary's College	Mazagon, Bombay.
Reddoch, Mrs. F. H. L.	*Europe.*
Reeve, Chas. F.	Nasrapur.
Reid, E. C.	Bombay.
Reid, Sir Marshal (C.I.E.)	*Europe.*
Reid, W. J. (I.C.S., C.I.E.)	Gauhati.
Reilly, Major N. E.	*Europe.*
Remington, G. L.	Ajmer.
Rendall, H. D. (I.C.S.)	Junagadh.
Reynolds, Capt. G. N.	Saugor, C. P.
Reynolds, L. W. (I.C.S., C.I.E.)	Jodhpur.
Ribeiro, J. (L.C.E.)	Bombay.
Rice, Capt. E. M. (I.A.R.O.)	Mesopotamia.
Richards, B. D. (B.SC.)	*Europe.*
Richmond, R. D. (I.F.S.)	Simla.
Ridland, J. G.	Bombay.
Rimington, F. J.	Bombay.
Rishworth, Lt. H. R. (I.M.S.)	Madras.
Ritchie, A. B.	Rangoon.
Ritchie, Major W. D. (I.M.S.)	Mesopotamia.

Rivett-Carnac, P. K.	Quetta.
Robert, A. W.	Madras.
Roberts, A. A. Lane (I.C.S.)	Delhi.
Roberts, Major A. S. B. (I.A.)	Rangoon.
Roberts, Dr. C. L. Digby	Bengal.
Roberts, Lt.-Col. Sir James (I.M.S., C.I.E.)	Bombay.
Roberts, Lt.-Col. M. B. (O.B.E.) (*Life Member*)	Garhwal.
Robertson, Sir Benjamin (I.C.S., K.C.S.I., C.I.E.)	Nagpur, C. P.
Robertson, J. H. (I.C.S.)	Madras.
Robertson, Laurence (C.S.I., I.C.S.)	Poona.
Robinson, A. C.	*Europe.*
Robinson, H. C.	Kuala Lumpur.
Robinson, Lt. J. A.	Jullunder.
Robinson, J. B.	Sagrampur.
Robinson, Hon'ble Mr. Justice S. M.	Rangoon.
Rocke, Capt. C. A.	*Europe.*
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RECEIPTS.	Rs. a. p.	Rs. a. p.
Balance on 1st January 1919..	....	14,727 5 8
War Loan Advances recoverable from Staff	....	593 0 4
Subscription for 1915 (in arrears)	30 12 0	
" " 1916 "	75 0 0	
" " 1917 "	193 14 6	
" " 1918 "	435 8 0	
" " the current year	19,067 8 1	
" " 1920 (in advance)	1,105 0 0	
" " 1921 "	15 0 0	
" " 1922 "	15 0 0	
Life Membership	400 0 0	
	21,337 10 7	
Less—Refund of Subscriptions	30 0 0	
		21,307 10 7
Grant-in-aid from the Bombay Government	5,000 0 0	
Entrance Fees	1,190 0 0	
Sales of Journal	1,873 6 4	
" " Snake Book	95 6 0	
" " White Ants	1 0 0	
" " Mesopotamia Notes	5 3 0	
" " List of Butterflies	4 7 0	
" " Catalogue of the Library	6 8 0	
" " Pigeon Book	172 7 0	
Charges recovered	218 2 0	
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Registration fees	279 6 0	
Sundries..	218 3 1	
Interest on Investments	1,751 6 0	
" " Fixed Deposit..	734 15 0	
" " Current Account	168 12 0	
" " Staff's War Bonds	49 8 0	
" " Society's War Bonds	550 0 0	
" " Treasury Bills..	126 0 8	
		12,459 10 1
Bank Balance overdrawn	....	278 0 11
		49 365 11 7

PAYMENTS.	Rs. a. p.	Rs. a. p.
Journal Account	12,563 1 7	
Salaries	13,409 1 11	
General Charges	949 11 9	
Rent	3,180 0 0	
Printing and Stationery	792 4 2	
Postal Expenses	749 10 0	
Petty Cash Expenses	511 3 0	
Library Account	194 7 9	
Furniture Account	210 0 0	
Audit Fee	130 0 0	
Fire Insurance Premium	318 12 0	
Mammal Fund Subscription	18 0 0	
Bank Charges	75 0 0	
Income Tax	153 10 6	
Advance to Staff..	155 0 0	
Expenses in connection with Mr. Prater's accident	267 0 0	
Passage to England for Mr. Kinnear	520 0 0	
		34,196 14 8
Investments.		
In Treasury Bills—Nominal value Rs. 15,000 at cost	14,621 14 0	
War Bond and Postal Certificates	469 12 0	
		15,091 10 0
Cash on hand	....	77 2 11
		49,365 11 7
Securities with the National Bank of India, Ld., Bombay.		
3½ % Government of India Promissory Notes.	8,800 0 0	
4 % Government of India Conversion Loan.	10,000 0 0	
4 % Bombay Port Trust Unguaranteed Bonds	14,000 0 0	
4 % City of Bombay Improvement Trust Bonds	15,000 0 0	
5½% War Bonds, 1920 Pro. Notes	10,000 0 0	
	57,800 0 0	

We have seen a letter from the National Bank of India, Limited, to the effect that the above Securities were held on the Society's behalf on 31st December 1919.

BOMBAY, 20*th February* 1920.
Examined and found correct.
(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors.

(Sd.) H. F. LODGE,
Honorary Treasurer,
Bombay Natural History Society.

(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors,

MAMMAL FUND ACCOUNT.

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of ACCOUNTS from 1st January to 31st December 1919.

	Rs. a. p.	Rs. a. p.
OPENING BALANCE OF 1ST JANUARY 1919.		
Fixed Deposit with Mercantile Bank ..	2,000 0 0	
Bombay Port Trust Unguaranteed Bonds of Rs. 5,000 at cost	5,150 0 0	
Balance of Postage	8 1 6	
Balance of Petty Cash	9 8 6	
Balance with National Bank	1,516 13 2	8,681 7 2
Donations received during 1919	7,332 14 4	
Interest on Investment	187 8 0	
Interest on Current Account	60 4 0	
Interest on Fixed Deposit	35 0 0	
Tents sold	89 0 0	
Amount paid by Col. Hotson being half expenses of the Mammal Collector ..	450 0 0	8,154 10 4
		16,839 1 6

	Rs. a. p.	Rs. a. p.
Salary of Mr. Baptista	456 2 0	
Allowance	111 9 8	
Salary of Nissa Prag	321 7 6	
Allowance	78 3 0	
Passage to Bombay for Mr. H. W. Wells (2nd Class P. & O. in September 1919)	582 0 0	
Salary of Mr. Wells	146 0 0	1,695 6 2
Cost of Cartridges..	68 8 0	
Bank Charges	16 2 0	
General Charges	28 6 0	
Cost of Gun..	140 0 0	
Freight on Specimen Boxes	37 8 3	
Collecting expenses	549 13 0	
Mr. Wells' initial expenditure	1,450 0 0	
Cost of Tent	258 0 0	
Stamp fee for Registering Guns, etc.	55 0 0	
Petty Cash Expenses	128 5 8	
Postage Expenses	22 14 0	2,754 8 11
CLOSING BALANCES—31ST DECEMBER 1919.		
Fixed Deposit with Mercantile Bank	2,000 0 0	
Bombay Port Trust Bonds of Rs. 5,000 at cost ..	5,150 0 0	
Balance of Postage	10 3 6	
Balance with National Bank	5,197 12 1	
Balance of Petty Cash	31 2 10	12,389 2 5
		16,839 1 6
Security with the National Bank of India, Limited, Bombay.		
4% Bombay Port Trust Bonds, 1912	....	5,000 0 0

We have seen a letter from the National Bank of India, Limited, to the effect that the above Security was held on the Society's behalf on 31st December 1913.

(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, ***Auditors,***

BOMBAY, 20*th February* 1920.
Examined and found correct.
(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors,

(Sd.) H. F. LODGE,
Honorary Treasurer,
Bombay Natural History Society.

NEW GENERIC TERMS.

		Page
Taterona	(Mammalia)	4
Guyia	(,,)	201
Diomys	(,,)	203

INDEX OF SPECIES.

NUMBER.

Abisara angulata 1022
—— bifæciata 1022
—— echerius 690, 1022
—— —— jhana 1022
—— fraterna 1022
—— fylla 1022
—— —— fyllaria 1022
—— kausambi paionea 1022
—— neophron 1022
—— —— chelina 1022
—— —— gratius 1022
—— —— neophron 1022
—— —— neophronides. .. 1022
—— prunosa 1022
Ablabes calamaria 569
—— pavo 683
Abrus precatorius 139
Abutilon 226
—— asiaticum 226
—— bidentatum 226
—— cornutum 227
—— fruticosum 227
—— indicum 226
—— muticum 226
Acacia 245
—— arabica 245, 246, 627
—— catechu 246
—— jaquemonti 246
—— leucophloea 246
—— pennata 442, 945
—— senegal 246
Acanthion hodgsoni 824
Acanthis spinoides 773
Acanthopneuste nitidus 991
—— occipitalis 606
—— trochiloides .. 606, 991
—— viridanus 606
Accentor himalayanus 609
—— nepalensis 609
Accipiter 1007, 1008

NUMBER.

Accipiter nisus .. 181, 617, 775, 845, 1009
—— virgatus 181, 1009
Aceros nepalensis 998
Achyranthes 817
—— aspera 817, 818
Acinonyx 44
—— jubatus 44
—— venaticus 44
Acisoma 492, 493
—— panorpoides panorpoides. 492, 493, 686
Acomys 785, 967
—— cahirinus 781
—— dimidiatus 967
—— flavidus 967
Acridotheres ginginianus .. 588, 992
—— tristis .. 588, 607, 772, 992
Acrocephalus dumetorum. 586, 605, 991
Actinodura egertoni egertoni 989
Actinopteris dichotoma 987
Adelura cæruleicephala 608
Ædon familiaris 292
Ægialitis alexandrina 187, 294
—— dubia 187, 596
Ægithaliscus erythrocephalus 602
—— niveigularis 603
Ægithalos erythrocephalus erythrocephalus 770
Ægithina tiphia 586, 989
Ærides crispum 486
Ærua 816
—— lanata 817
—— pseudo-tomentosa 817
—— tomentosa .. 222, 234, 540, 816
Æsalon chicquera 182
—— regulus 846
Æthiopsar fuscus 607, 992
Æthopyga gouldiæ 612, 996
—— ignicauda 428, 996
—— saturata 996

NUMBER.
Æthopyga seheriæ 996
Ageratum 533
——— conyzoides 533
Agrionoptera 147
——— lineata 153
——— simularis 147
Ailanthus excelsa 625
Ailurus 350
——— fulgens 350
Ainsliæa pteropoda 695
Alactagulus indicus 778
Alauda gulgula 590, 995
Alaudula adamsi 174, 590
——— raytal 995
Albizzia 246
——— lebbek 246
——— stipulata 823
Alcedo beavani 998
——— ispida .. 176, 591, 614, 997, 998
Alcurus striatus 990
Alhagi camelorum 241
Allactaga hotsoni 936
——— indica 936, 937
——— mongolica 936
——— williamsi 936
Allium 973
——— cepa 973
Allophyllus cobe 477, 945
Allotinus apthonius 102
——— fabius panormis 1023
——— horsfieldii continentalis ..1023
——— nivalis substrigosa 1022
——— subviolaceus 1022
——— ——— manychus ..1022
Aloe sp. 973
Alseonax latirostris .. 588, 607, 993
——— muttii 667
——— ruficaudus 607
Alternanthera 818
——— triandra 818
Alysicarpus 240
——— hamosus 240
——— monilifer 240
——— rugosus 240, 241
——— tetragonolobus 241

NUMBER.
Alysicarpus vaginalis 240
Amarantus 816
——— blitum oleracea 816
——— gangeticus 816
——— ——— tristis . .. 816
——— paniculatus 816
——— polygamus 816
——— spinosus 816
——— viridis 816
Amaurornis phœnicurus 185
Amblypodia 438, 444, 447
——— anita 444
Ammannia 210, 526
——— degyptiaca 215
——— arenaria 211
——— attenuata 215
——— auriculata .. 210, 211, 213, 215
——— australasica 212
——— baccifera 210, 215
——— coccinea 211
——— cordata 215, 216
——— debilis 215
——— densiflora 215
——— desertorum .. 210, 213, 527
——— floribunda 212
——— glauca 215
——— indica 215
——— japonica 212
——— lanceolata 215, 216
——— longypes 211
——— madagascariensis 212
——— multiflora . 210, 212, 214, 527
——— octandra 210, 211
——— parviflora 212
——— pusilla 211
——— racemosa 211
——— salicifolia 215, 216
——— senegalensis 215, 214, 211, 210
——— triflora 216
——— undulata 211
——— vesicatoria 215
——— wrightii 211
Ammanella linearis 211
Ammoperdix bonhami 294
Ampeliceps coronatus 856

NUMBER.
Anaphæis mesentina .. 690
Anathana .. 28
—— ellioti .. 29
—— pallida .. 29
—— wroughtoni .. 29
Anas boscas .. 191, 291, 842
—— pacilorhyncha .. 675, 842
Anax guttatus .. 874
Ancistrodon millardi .. 578
Andrographis .. 811
—— echioides .. 811
Andropogon .. 981
—— annulatus .. 981
—— foveolatus .. 981
—— iwarancusa .. 981
—— pertusus .. 981
—— sorghum .. 981
—— squarrosus .. 981
Androsace rotundifolia .. 696
Anogeissus .. 525
—— acuminata .. 525
—— pendula .. 525
—— rotundifolia .. 525
—— sericea .. 526
Anomalococcus indicus .. 627
Anorthura neglecta .. 605
Anourosorex .. 38
—— assamensis .. 38
—— squamipes .. 38
Anser ferus .. 190, 620
—— indicus .. 190
Antheræa roylei .. 300, 301
Anthipes poliogenys .. 993
Anthothreptes simplex .. 857
Anthracoceros albirostris .. 176, 998
—— coronatus .. 671
Anthus blakistoni .. 173
—— campestris .. 173, 612
—— maculus .. 612, 995
—— richardi .. 995
—— rosaceus .. 612
—— rufulus .. 589, 612, 995
—— similis .. 173, 612, 995
—— spinoletta .. 612

NUMBER.
Anthus striolatus .. 995
—— trivialis .. 173, 612
Anticharis .. 549
—— glandulosa .. 549
—— linearis .. 549
Antidesma ghæsembilla .. 945
Antilope cervicapra .. 825, 841
Aonyx .. 349
—— cinerea .. 349
—— leptonyx .. 349
—— leuconyx .. 823
Aphnæus .. 473
—— concanus .. 478
—— himalayanus .. 478
—— hypargyrus .. 482
—— ichita .. 477
—— ictis .. 481, 482
—— lazularia .. 478
—— lillacinus .. 481
—— lohita .. 478, 480, 482
—— syama .. 478
—— vulcanus .. 473, 478
—— zebrinus .. 478
—— zoilus .. 478
Apluda .. 980
—— aristata .. 980
Apodemus .. 785, 966
—— agrarius .. 782
—— arianus .. 966
—— sublimis .. 966
—— sylvaticus pentax .. 966
—— —— rusiges .. 966
—— wardi .. 966
Aquila .. 636
—— bifasciata .. 616, 631, 637, 638, 639, 846
—— chrysaëtus. 248, 616, 630, 631, 633
—— fulvescens .. 180
—— heliaca .. 180, 631, 636, 638, 845
—— imperialis .. 180, 632
—— maculata .. 247, 631, 642, 845
—— vindhiana .. 180, 593, 631, 640, 642, 846, 1041
Arachnechthra asiatica .. 612, 174, 286, 591, 857, 996

NUMBER.
Arachnechthra flammaxillaris .. 856
Arachnothera aurata .. 669
——— longirostis .. 670, 996
——— magna .. 428, 670, 996
Arboricola torqueola .. 619, 849
Archibuteo .. 654
——— hemiptilopus .. 631, 654
Arctictis .. 53
——— binturong .. 53
——— gairdneri .. 53
Arctogalidia .. 52
——— leucotis .. 52
Arctonyx .. 281, 347
——— collaris .. 347, 348, 823
——— dictator .. 347, 348
——— taxoides .. 347, 348
Ardea cinerea .. 189, 598, 620
——— manillensis .. 189, 597
Ardeola grayi .. 190, 598, 620
Ardetta cinnomomea .. 598
——— minuta .. 294
——— sinensis .. 598
Ardisia hunilis .. 871
Argemone .. 219
——— mexicana .. 219
Argya caudata .. 585, 603
——— earlii .. 585, 675, 988
——— longirostris .. 988
——— malcolmi .. 585
Arhopala .. 446, 455, 457
——— abseus .. 446
——— amantes .. 446, 447, 448, 450, 453, 454, 750
——— anita .. 446
——— atrax .. 454
——— bazaloides .. 446
——— canaraica .. 446
——— centaurus .. 122, 446, 447, 453, 456, 750
——— corruscans .. 447, 450
——— eumolphus .. 446
——— hewitsoni .. 446, 453, 454
——— pirithous .. 447
——— pseudocentaurus .. 447
Aristida .. 982

NUMBER.
Aristida adscenscionis .. 982
——— funiculata .. 982
——— hirtigluma .. 982
——— hystricula .. 982
——— mutabilis .. 982
Aristolochia .. 969
——— bracteata .. 969
Arnebia .. 543
——— hispidissima .. 543
Artamus fuscus .. 426, 992
Artocarpus incisa .. 628
Arundinax áédon .. 991
Asio accipitrinus .. 178
Asparagus .. 972
——— racemosus .. 972
Aspidiotus (Chrysomphalus) aurantii .. 623
——— camelliæ .. 623
——— destructor .. 623
——— ficus .. 623
Asphodelus .. 972
——— tenuifolius .. 972
Astur .. 1007, 1008
——— badius .. 181, 593, 617, 1009
——— palumbarius .. 1009
Atella phalantha .. 690
Athene brama .. 178, 593, 1045
Atriplex sp. .. 968
Aulocera sarasvati .. 870
Auzakia danava .. 870
Axis axis .. 841, 661, 825
——— porcinus .. 825
Azadirachta .. 233
——— indica .. 233

Badamia exclamationis .. 691
Balanites .. 232
——— roxburghii .. 232
Balsamodendron roxburghii .. 233
Bandicota .. 783, 785
——— elliotana .. 786, 824
——— gigantea .. 782, 785

NUMBER.

Bandicota indica 786
——— malabarica 786
——— nemorivaga 786
——— savilei 786
Barbastella darjilingensis 823
Barleria 811
——— acanthoides 811
——— hochstetteri 812
——— prionitis 811
Bauhinia 244
Belomys 357
——— pearsoni 357
——— trichotis 357
Berberis lycium 695
Bergia 225
——— ammannioides 225
——— odorata 225
——— æstivosa 225
Boselaphus tragocamelus 841
Bhringa remifer 990
Bibasis sena 461
Bibos gaurus 825
——— gaurus 1035
Bidens 536
——— pilosa 536
Bindahara 951
——— sugriva 951, 954
Blabephorus pinguis 301
Blainvillea 535
——— rhomboidea 535
Blarinella 36
——— wardi 37
Blastania 529
——— fimbristipula 529
Blastospora butleri 696
Blepharis 811
——— sindica 811
Blumea 533
——— amplectens 533
Bœrhaavia 815
——— diffusa 815
——— elegans 815
——— verticillata 815
Boswellia serrata 233
Botaurus stellaris 190

NUMBER.

Bouchea marrubifolia 813
Brachydiplax 490
——— farinosa 490, 492
——— pruinosa 492
——— sobrina .. 490, 491, 492, 686
Brachypternus aurantius. 175, 591, 613
Brachythemis 737
——— contaminata .. 686, 737, 738, 739
——— fuscopalliata 738
Bradinopyga 514
———geminata 514, 686
Brassica campestris 220
——— oleracea 220
Breweria 544
——— latifolia 544
Bubalis bubalis 825
Bubo bengalensis 178
——— coromandus 178, 593
Bubulcus coromandus 190, 598
Budorcas bedfordi 838, 839
——— taxicolor .. 838, 839, 840
——— tibetanus 838, 839
Bufo melanostictus .. 560, 562, 563, 566
Bulbostylis 197
——— barbata 197
——— capillaris 198
——— puberula 198
Bungarus cæruleus .. 575, 684, 1046
——— fasciatus 580
Butastur 1007, 1008, 1012
——— teesa 180, 593, 1007, 1008, 1012
Butea frondosa 305
Buteo 241, 826, 1000
——— desertorum. 826, 827, 835, 845, 1001
——— ferox .. 181, 617, 827, 832, 845, 1000, 1001, 1002, 1003
——— frondosa 135, 241, 305
——— leucocephalus 827, 1000
——— plumipes 826
——— vulgaris 826
Butorides javanica 598

NUMBER.

Caccabis chucar 619, 775
Cacergates fuscopalliata 738
Cacomantis merulinus 999
——— passerinus 428, 999
Caconeura canningi 877
——— mackwoodi 876
Cadaba 222
——— indica 222
Calamaria pavimentata 684, 866
Calamintha umbrosa 696
Calandrella brachydactyla .. 174, 293
——— minor 293
Callacanthis burtoni 610
Callialcyon lilacina 998
Calligonum 969
——— polygonoides 969
Calliope camtschatkensis 994
——— tschebaiewi 994
Callophis bibroni 577
Callosciurus 365
——— atrodorsalis .. 365, 368
——— ——— shanicus. 365, 368
——— caniceps 365, 366
——— crumpi 365, 368
——— epomophorus davisoni. 366, 368
——— erythræus .. 365, 366, 368
——— ——— bhutanensis .. 368
——— ——— crotalius .. 369
——— ——— erythræus. 368, 369
——— ——— erythrogaster .. 369
——— ——— kinneari .. 369
——— ——— nagarum. 369, 370
——— ——— punctatissimus.. 369
——— ferrugineus 365, 368
——— gordoni 366, 370
——— griseimanus 365
——— quinquestriatus .. 365, 366, 370
——— rubeculus 366, 370
——— sladeni 365, 366
——— ——— careyi 367
——— ——— fryanus 367
——— ——— haringtoni 367
——— ——— midas .. 366, 367
——— ——— millardi .. 366, 367
——— ——— rubex .. 366, 367

NUMBER.

Callosciurus sladeni shortridgei. 366, 367
——— ——— sladeni .. 366, 367
——— stevensi 365, 368
Calomyscus bailwardi 938, 939
——— baluchi 939
——— hotsoni 939
Calotes versicolor .. 570, 571, 579
Calothemis 141
——— acigastra 142
Calotropis 539
——— procera 246, 539
Calyptomena viridis 858
Camena 457, 464, 467, 469
——— argentea ..458, 462, 465, 467
——— cippus 472
——— cleobis 457
——— ctesia 457
——— deva 472
Camponotus compressus .. 118, 627
Campophaga melanoptera 524
——— melanoschista .. 524, 607, 992
——— sykesi 992
Canavalia 241
——— ensiformis 241, 1049
Canis 338
——— aureus 338
——— indica 823
——— indicus indicus 339
——— ——— kola .. 339, 340, 1028
——— laniger 339
——— lanka 339, 340
——— lupus 338
——— naria 339, 340, 1033
——— pallipes 338, 339
Cannabis 972
——— sativa 972
Canthium parviflorum 477
Capparis 222
——— aphylla 222, 540
——— decidua 222
——— grandis 222
——— sodada.. 222
——— spinosa 222
Caprimulgus ægypticus .. 1043
——— asiaticus 177

NUMBER.
Caprimulgus europæus .. 428
—— —— indicus .. 614
—— —— macrurus .. 999
—— —— monticola .. 592, 614, 999
—— —— unwini .. 428
Capsicum .. 549
—— annuum .. 549
Cardamine impatiens .. 695
Cardiospermum halicacabum .. 235
Carduelis caniceps .. 610, 676
Carega arborea .. 871
Carex .. 208
—— condensata .. 209
—— mercarensis .. 208
—— speciosa .. 209
Carpodocus erythrinus .. 589, 610, 995
Carpophaga ænea ænea .. 846
Caryopteris grata .. 696
—— wallichiana .. 696
Casarca rufila .. 842
—— rutila .. 190, 620
Cassia .. 244
—— auriculata .. 244
—— kleinii .. 244
—— obovata .. 244
—— obtusa .. 244
Cassytha .. 967
—— filiformis .. 969
Castalius .. 123, 128
—— ananda .. 123
—— decidea .. 124, 129
—— ethion .. 126, 127, 132
—— rosimon .. 129, 691
Catapæcilma .. 759
—— elegans .. 759
Catachrysops .. 107
—— atrabo .. 108
—— cnejus .. 110, 691
—— pandava .. 112, 691
—— strabo .. 691
Catopsilia .. 462
—— crocale .. 690
—— florella .. 690
—— pomona .. 690
—— pyranthe .. 690

NUMBER.
Catreus .. 1
—— wallichi .. 1, 2, 619
Celerio euphorbiæ .. 872
Celosia .. 815
—— argentea .. 815
Celsia .. 549
—— coromandeliana .. 549
Celythemis phyllis .. 931
Cenchrus .. 979
—— biflorus .. 979
—— catharticus .. 979
Centropus bengalensis .. 429, 999
—— sinensis .. 177, 592, 999
Cephalopyrus flammiceps. 604, 675, 990
Cerastium glomeratum .. 695
Ceratina viridissima .. 872
Cerberus .. 89
—— rhynchops .. 89, 581, 584
Cercomela fusca .. 588, 667, 843
Ceriornis blythi .. 891
—— caboti .. 906
—— macrolophus .. 707
—— melanocephala .. 885
—— modestus .. 906
—— satyra .. 707
—— temmincki .. 891, 901
Cerococcus hibisci .. 627
Ceropegia wallichii .. 696
Ceroplastodes cajani .. 625
Certhia himalayana .. 605
—— —— himalayana .. 771
Cervus cashmirianus .. 1038
Ceryle lugubris .. 613, 998
—— varia .. 176, 591, 998
Cethosia cyane .. 690
Ceyx tridactyla .. 998
Chærephon .. 27
—— plicatus .. 27
Chærocampa alecto .. 299
Chætura .. 591
Chaimarrornis leucocephala .. 772
Chalcopharia phœnicotis .. 990
Chalcophaps indica .. 618, 671
Chaptia ænea .. 990
Chara sp. .. 219

NUMBER.
Charasia .. 565
Charadrius fulvus .. 187
——— dorsalis .. 571, 573, 578
Charaxas fabius .. 1021
——— ——— cerynthus .. 1021
——— polyxena .. 1021
——— ——— agna .. 1022
——— ——— hemana .. 1021
——— ——— hierax .. 1022
——— ——— hindia .. 1021
——— ——— rossa .. 1022
Charaxes athamas .. 462
——— imna .. 462
——— schreiberi .. 462
Chaulelasmus streperus .. 191, 842
Chelidon kashmiriensis .. 611
Chelidorhynx hypoxantha .. 772
——— hypoxanthum 427, 608, 993
Cheliones .. 726
——— hurrianœ collinus .. 726
Chenopodium .. 968
——— album .. 968
Cheritra freja .. 951
——— jaffra .. 766, 948, 951
Chersydrus granulatus .. 584
Chettusia gregaria .. 187
——— leucura .. 187, 294
Chibia hottentotta .. 425, 990
Chilades laius .. 691
——— trochillus .. 691
Chimarrhornis leucocephalus .. 608, 993
Chimmarrogale .. 38
——— himalayica .. 38
Chionaspis vitis .. 622
Chiropodomys .. 785, 965
——— gliroides .. 965
——— peguensis .. 965, 966
——— penicillatus .. 782
Chliaria .. 484
——— cachara .. 484
——— kina .. 484
——— nilgirica .. 486
——— othona .. 484, 485
Chloropsis aurifrons .. 990
——— hardwickii .. 990

NUMBER
Chætura nudipes .. 614, 998
Chætornis locustelloides .. 586
Chorlis .. 983
——— pallida .. 983
——— polystachya .. 984
——— quinquesetica .. 984
——— tenella .. 983
——— villosa .. 984
——— virgata .. 984
Chrysanthemum .. 536
——— indicum .. 536
Chrysococcyx xanthorhynchus .. 999
Chrysocolaptes gutticristatus .. 997
Chrysopelea ornata .. 574
Chrysophlegma flavinucha .. 996
Cicer .. 242
——— arietinum .. 242
Ciconia alba .. 189, 294
Cinclus asiaticus .. 609, 994
Cinnyris currucaria .. 175
Circaëtus .. 1007, 1008, 1009
——— gallicus .. 180, 617, 774, 1008, 1009
Circus .. 1007, 1008
——— cyaneus .. 617, 1009
——— macrurus .. 181, 593, 845, 1009
——— æruginosus 181, 593, 617, 845, 1009
Cissa chinensis .. 854, 988
Cistanche .. 550
——— tubulosa .. 550
Cisticola cursitans .. 586
——— tytleri .. 991
Citrullus .. 528
——— colocynthis .. 528
——— vulgaris .. 529
Citrus .. 232
——— aurantium .. 232
——— medica .. 232
Cittocincla macrura .. 427, 994
Clemmys caspica .. 295
Cleome .. 220
——— brachycarpa .. 221
——— papillosa .. 220
——— riscosa .. 221
Clerodendron .. 813
——— phlomidis .. 813

NUMBER.
Clerodendron siphonanthus 477
Clitoria ternatea.. 1049
Coccinia.. 529
———— indica 529
Coccinella 7-punctata 848
Cocculus 219
———— cebatha 219
———— villosus 219
Coccystes coromandus 429, 999
———— jacobinus 590, 592, 603, 615, 999
Cochoa purpurea.. 669
Cœlomys 785, 962
———— bicolor.. 962
———— mayori.. .. .. 782, 962
Cœsulia 534
———— axillaris 534
Collocalia brevirostris 614
———— francica 858, 859
———— fusciphaga 177, 998
———— innominata 858, 859
Colotis amata 868, 869
———— vestalis 868, 869
Coluber helena 566
———— pavo 865
———— porphyraceus 866
Columba eversmanni 183, 594
———— intermedia .. 183, 594, 618
———— livia 618
Commelina 973
———— albescens 973
———— bengalensis 973
———— forskalœi 973
Commiphora 232
———— agallœha 233
———— mukul .. 232, 246, 971
Conchoderma hunteri 809
Contia brevicauda .. .. .1024
———— condoni 1024
———— fasciata 1024
Convolvulus 544
———— arvensis 545
———— conglomeratus 544
———— densiflorus 545
———— glomeratus 544
———— gracilis 545

NUMBER.
Convolvulus microphyllus 544
———— pluricaulis 545
———— rhyniospermus 545
———— rottlerianus 544
Copsychus saularis ..576, 588, 608, 994
Coracias affinis 618, 997
———— bengalensis 861
———— garrulus 293, 861
———— indica 176, 591, 861, 997
Corallocarpus 530
———— epigæus 530
Corchorus 229
———— acutangulus 230
———— antichorus 230, 970
———— fescicularis 229
———— olitorius 229
———— tridens 230
———— trilocularis 229
Cordia 541
———— rothii 541
Coriaria nepalensis .. 762, 763, 764
Corvus capellanus 292
———— corax 585
———— ———— tibetanum 848
———— insolens 523
———— macrorhynchus .. 601, 634, 988
———— ———————— levaillanti .. 770
———— splendens ..289, 523, 585, 592, 601, 843, 988
———— ———— protegatus 523
———— ———— zugmeyeri 523
Corydon sumatranus 857
Cotile sinensis 611, 995
Cottonia macrostachys 485, 486
Cotula 536
———— hemisphœrica 536
Coturnix communis 185, 619
———— coromandelica 594
Courtoisia 192
———— cyperoides 192
Crateropus canorus 585, 603
———— terricolor terricolor .. 988
Cratilla 152
———— calverti 153
———— lineata 153

NUMBER.

Cratilla metallica 153, 154
Cremastogaster 122, 469, 476, 479
Cremnomys 784, 799
——— australis 800
——— ——— siva 800
——— cutchicus .. 782, 799, 800
——— medius 800
——— ——— cænosus 800
——— ——— rajput 800
Creon 457
—— cleobis 463, 465
Creoplastes actiniformis 624
Cressa 544
—— cretica 544
Criniger flaveolus 990
Crocidura 37
——— aranea 37
——— fuleginosa 37
——— fumigata 37
——— horsfieldi 37
Crocopus chlorogaster 183, 594
——— phœnicopterus 183
Crocothemis 515
——— cruentala 505
——— erythæa 516, 517
——— reticulata 516
——— rufa 505
——— servilia .. 515, 516, 686, 687
——— ——— servilia .. 516, 517
——— soror 516
Crotalaria 235
——— burhia 235
——— capensis 135
——— medicaginea 235
——— retusa 236
——— striata 1047
Crypsirhina varians 853
Cryptolopha burkii 606, 991
——— cantator 991
——— xanthoschista .. 606, 614
——— xanthoschistos xanthoschistos. 772
Cryptostegia 540
——— grandiflora 540
Cryptotheca apetala 215

NUMBER.

Cuculus canorus .. 592, 606, 614, 671, 999
——— micropterus 614, 999
——— saturatus .. 606, 614, 999
Cucumis 528
——— melo 528
——— prophetarum 528
——— trigonus 528
Cucurbita 530
——— maxima 530
Culicicapa ceylonensis .. 607, 772, 993
Cuon 340
—— dukhunensis .. 340, 661, 823, 837, 1032, 1033
—— rutilans 340, 341
Curetis 135, 140
—— bulis 135, 139
—— thetis 135, 136, 139, 462
Cursorius coromandelicus .. 186, 595
——— gallicus 186
Cuscuta 543
—— hyalina 543
Cyamopsis 236
——— psoralioides 236
Cyanecula suecica 588, 994
Cyaniris limbata 871, 872
——— puspa 116
Cyanoderma erythropterum 855
Cyanops asiatica 613, 997
—— cyanotis 997
—— rubescens 997
Cyanotis 973
——— axillaris 973
Cyathocline 533
——— lyrata 533
Cydnus indicus 681
Cylindrophis maculatus 863
Cymbopogon 982
——— martini 982
Cymborhynchus macrorhynchus .. 857
Cynælurus jubatus 1041
Cynodon 983
——— barberi 304, 305
——— dactylon .. 304, 305, 983
——— intermedius 304, 305
Cynopterus sphinx sphinx .. 823, 1025

NUMBER.

Cynthia saloma .. 462
Cyornis leucomelanurus .. 426, 607, 993
—— melanoleucus .. 993
—— rubeculoides 426, 607, 993
—— superciliaris .. 607
Cyperus .. 974
—— arenarius .. 974
—— aristatus .. 974
—— bulbosus .. 975
—— compressus .. 974
—— conglomeratus .. 974
—— difformis .. 974
—— eleusinoides .. 975
—— iria .. 975
—— niveus .. 974
—— pumilus .. 974
—— pygmaeus .. 202, 974
—— rotundus .. 975
—— tuberosus .. 975
Cyprellus pallidus .. 293
Cypselus affinis .. 176, 591, 614, 998
—— leuconyx .. 614
—— melba .. 614, 998
—— murinus .. 293
—— pacificus .. 998

Dacnomys .. 784, 790
—— millardi .. 782, 790
Dactylopius indicus .. 626
Dafila acuta .. 191, 842
Dalbergia .. 244
—— lanceolaria .. 627
—— latifolia .. 462
—— sissoo .. 244
Danais chrysippus .. 689
—— limniace .. 689, 1047
—— plexippus .. 689
Daphnis nerii .. 299
Datura .. 548
—— fastuosa .. 548
Deilephila livornica .. 872
Delias eucharis .. 690

NUMBER.

Dendrocyna javanica .. 842
Dendrelaphis caudolineatus .. 580
—— tristis .. 567
Dendrobium chrysotoxum .. 897
Dendrocitta himalayensis .. 602, 988
—— rufa .. 585, 602, 988
Dendrocopus auriceps .. 175, 613
—— himalayensis .. 613
—— macii .. 613, 996
Dendrophis pictus .. 580
Dendrotreron hodgsoni .. 846
Derris scandens .. 139
Desmostachya .. 986
—— bipinnata .. 986
Deudoryx .. 767
—— epijarbas .. 691, 767
Diardigallus praelatus .. 15
—— fasciolatus .. 15
Diaspis echinocacti .. 622
Dicæum cruentatum .. 996
—— erythrorhynchus .. 612, 996
—— ignipectus .. 996
—— olivaceum .. 996
Dichoceros bicornis .. 998
Dichrostachys cinerea .. 245
Dicoma .. 537
—— tomentosa .. 537
Dicrurus annectens .. 990, 999
—— ater .. 586, 605, 990
—— longicaudatus .. 605, 675, 990
—— nigrescens .. 856
Digera .. 815
—— arvensis .. 815
Digitalis purpurea .. 308
Digitaria .. 977
—— pennata .. 977
—— sanquinalis .. 977
—— —— var. ciliaris .. 977
Dioscorea .. 457
—— pentophylla .. 480
Diospyros embryopteris .. 762
Dipcadi erythræum .. 972
Diplacodes .. 500
—— nebulosa .. 500, 501, 686, 687
—— parvula .. 876

NUMBER.

Diplacodes trivialis .. 500, 501, 502, 503, 686
Diplax commixta 498
—— dryas 926
—— equestris 510
—— fonscolombei 497
—— hypomelas 498
—— meridionalis 735
—— nebulosa 501
—— orientale 499
—— sobrina 491
—— striolata 495
—— trivialis 503
—— vulgata 495, 497
Diplostemon octandrum 211
Dipodillus 779
—— arabium 935
—— indus 935, 936
—— nanus 779, 935, 936
—— swinhœi 779
Dipsadomorphus ceylonensis .. 570, 571
—— forsteni 571
—— multifasciatus .. 866
—— nuchalis 571
—— trigonatus 569
Dischrostachys 245
Disparoneura fletcheri 876
Dissemurus paradiseus 990
Dissura episcopus 189
Dodona adonira 1022
—— argentea 1022
—— binghami 1022
—— dipœa 1022
—— nostia 1022
—— eugenes 1022
—— venox 1022
—— longicaudata 1022
—— ouida 1022
—— phlegra 1022
Dœmia 540
—— extensa 540
Doleschallia polybete 462
Dolichos 242
—— biflorus 242
Dremomys 363

NUMBER.

Dremomys lokria 363
—— bhotia 363, 364, 824
—— lokria .. 363, 364
—— macmillani 363, 364
—— pernyi 364
—— rufigenis 363, 364
—— adamsoni .. 364, 365
—— opimus 364
Dryobates auriceps 774
Dryonastes chinensis 854, 855
—— ruficollis 988
Dryophis mycterizans ..563, 572, 578, 681, 862, 863
—— perroteti 571
—— pulverulentus 574
Dythemis infernalis 925
Dysdercus cingulatus 872

Echinops 537
—— echinatus 537
Echinus esculentus 483
Echis carinatus 577
Eclipta 535
—— erecta 535
Ehretia 541
—— aspera 541
Elæagnus latifolia 622
Elanus 1005
—— cæruleus ..181, 617, 826, 827, 1005, 1041
Eleocharis 197, 198, 976
—— atropurpurea .. 198, 199, 976
—— capitata 198, 199
—— chaetaria .. 198, 199, 312
—— congesta 312
—— fistulosa 198, 199
—— palustris 198, 199
—— plantaginea 198
—— spiralis 198, 199
Elephas maximas 825
Eleusine 984

NUMBER.

Eleusine ægyptiaca 984
——— aristata 984
——— flagellifera 984
Elionurus 980
——— hirsutus 981
——— royleanus 980
Emballonura 23
——— monticola 23
Emberiza aureola 995
——— cia stracheyi 774
——— fucata 676
——— ——— arcuata 774
——— leucocephala 611
——— luteola 293, 676
——— pusilla 995
——— rutila 995
——— schœnicles 676
——— stewarti 611
——— stracheyi 611
Enallagma assamica 877
Enhydrina 96
——— valakadyn 96, 803
Enhydris 94
——— curtus 94
Enicostemma 540
——— littorale 540
Eoglaucomys 358
——— fimbriatus 358
Ephedra 972
——— foliata 972
Epimys kandianus 387
——— kelaarti 411
——— nemoralis 408
——— nitidus 412
——— rufescens ..68, 77, 83, 87, 384, 389, 394, 398, 400, 402, 403, 409
Eptesicus hingstoni 745
——— innesi 745
——— matschiei 746
——— pellucens 746, 747
——— serotinus 745
——— turcomanus 745
——— walli 746
Eragrostis 985
——— ciliaris 985

NUMBER.

Eragrostis ciliaris var. brachystachya .. 985
——— interrupta 985
——— major 986
——— minor 986
——— pilosa 986
——— plumosa 985
——— stenophylla 986
——— tremula 986
——— viscosa 985
Eribæa agrarius 1021
——— arja 1021
——— ——— ræberi 1021
——— ——— vernus 1021
——— athamas 1021
——— ——— agrarius 1021
——— ——— andamanicus 1021
——— ——— bharata 1021
——— ——— hamasta 1021
——— ——— madeus 1021
——— eudamippus 1021
——— ——— jamblichus ..1021
——— jalysus 1021
——— ——— ephebus 1021
——— moori 1021
——— ——— marginalis 1021
——— ——— sandakanus 1021
——— schreiberi 1021
——— ——— tisamenus 1021
Erigeron alpinus 696
——— canadense 696
Eriochiton cajani 625
Eriophorum 203
——— comosum 203
Erodium 232
——— cicutarium 232
Erythemis oblita 505
——— rufa 505
——— servilia 516
——— testacea 168
Erythrina 1050
——— caffra 1050
——— crista galli 1050
——— indica 1050
——— lithosperma 624
Esacus recurvirostris 186, 595

NUMBER.
Euaspa milionea 870
Eublemma scitula 627
Eucalyptus sp. 526
Eudynamis honorata .. 177, 592, 999
Eugenia 526
——— jambolana 526
Eulabes intermedia 992
Eulepis dolon 870
Eupetaurus 354
——— cinereus 354
Euphorbia 970
——— clarkeana 971
——— devergens 600
——— dracunculoides 970
——— elegans 970
——— glanca 600
——— granulata 970
——— hirta 970
——— hypericifolia 970
——— jodhpurensis 971
——— rothiana 599, 600
——— læta 599
——— microphylla 971
——— neriifolia 219, 940
——— nivulia 540
——— oreophila 599
——— pilosa 696
——— segetalis 600
——— thymifolia 970
Euplocamus diardi 15
——— ignitus 10
——— praelatus 15
——— rufus 10
——— sumatranus 11
——— vieilloti 10
Euplœa core 689, 1047
Eupodotis edwardsi 595, 673
Euripus consimilis 1021
——— ——— amala 1021
——— ——— diocletiana 1021
——— ——— eurimus 1021
——— ——— gudila 1021
——— ——— meridionalis .. 1021
——— ——— sunta 1021
——— ——— triquilla 1021

NUMBER.
Euripus halitherses 1021
——— ——— alcathæoides .. 1021
——— ——— cinnamoneus .. 1021
——— ——— gulussa 1021
——— ——— gyrtona 1021
——— ——— haliartus 1021
——— ——— isa 1021
——— ——— mastor 1021
——— ——— neda 1021
——— ——— nyctelius 1021
——— ——— kademoides .. 1021
Eurystomus orientalis 428, 997
Euthalia nais 689
Everes argiades 132, 691
Evolvulus 544
——— alsinoides 544
Excalfactoria chinensis 1044
Exostoma stoliczikne 295

Fagonia 231
——— arabica 231
——— bruguieri 231
——— cretica 231
Fagopyrum 969
——— esculentum 969
Falco barbarus 845
——— cherrug 182, 846
——— jugger 182, 590, 593, 618
——— milvipes 182
——— peregrinator 618
——— peregrinus 182, 845
——— ——— peregrinator 775
——— sacer 182
——— subbuteo 618, 846
——— tinnunculus 775
Farsetia 219
——— ægyptiaca 220
——— hamiltonii 220
——— jacquemontii 219
——— macrantha 220
Felis 40
——— affinis .. 42, 43, 822, 1027, 1032

NUMBER.
Felis bengalensis .. 40, 41, 43, 822, 1032
—— caracal 40, 44, 1041
—— chaus 40
—— isabellina 44
—— leo 40, 41, 42
—— lynx 40
—— manul 40, 42, 43
—— marmorata 40, 41, 43, 822
—— nebulosa 40, 41, 43, 822
—— ornata 40, 41, 42
—— pardus .. 40, 41, 42, 822, 841
—— rubiginosa 40, 41, 42, 1027
—— temmincki 40, 41, 43, 822
—— tigris .. 40, 41, 42, 659, 822, 837, 841
—— torquata 40, 42, 44
—— uncia 40, 41, 43
—— viverrina 40, 41, 42, 822
Feroculus 37
Ficus 971
—— bengalensis 972
—— mysorensis 972
—— religiosa 971
Filices 987
Fimbristylis 192, 197, 975
—— acuminata 193, 312
—— argentea 193, 194
—— complanata .. 195, 197
—— —— microcarya .. 197
—— dichotoma 194, 975
—— digitata 195
—— diphylla 194, 195
—— —— annua 195
—— —— pleristriata .. 195
—— ferruginea .. 194, 195, 975
—— glomerata 203, 204
—— junciformis .. 195, 196
—— miliacea 195, 196
—— monostachya 192
—— monticola 196
—— œstivalis 194
—— polytrichoides 193
—— quinquangularis 195, 196, 975
—— schœnoides .. 193, 194
—— spathacea 194

NUMBER.
Fimbristylis tenera .. 196, 197, 976
—— —— oxylepis 195, 196, 976
—— tetragona 193
—— umbellata 203, 204
—— uncinata 203, 204
—— wallichiana 203
—— woodrowii 195, 196
Flaveria 538
—— contrayerba 538
Forficula planticollis 848
Francolinus pondicerianus 185, 594, 620
—— vulgaris .. 185, 594, 619
Franklinia buchanani 586
—— cinereicapilla 991
—— gracilis 605, 991
—— rufescens 991
Fringilanda sordida 611
Fuirena 203
Fulica atra 185, 620
Fuligula fuligula 842
Funambulus 372
—— bengalensis .. 374, 376
—— dravidianus .. 374, 377
—— gossei 730, 1033
—— kathleenæ 374, 377
—— layardi .. 373, 374, 377
—— numarius 729, 730
—— palmarum 373
—— —— bellaricus 374, 375
—— —— brodiei .. 373, 375
—— —— comorinus 373, 375
—— —— favonicus 374, 375
—— —— kelaarti 373, 375
—— —— olympius 374, 375
—— —— palmarum .. 375
—— pennanti 374
—— —— argentescens 374, 376
—— —— lutescens 374, 376
—— —— pennanti 376, 824, 1028
—— robertsoni 374, 376
—— striatus 576
—— sublineatus 373, 374, 377, 1033
—— thomasi .. 729, 730, 1028
—— tristriatus .. 373, 374, 728, 729, 730

NUMBER.
Funambulus tristriatus numarius 374, 376
—— —— tristriatus .. 376
—— wroughtoni .. 374, 376, 729

Galega incana 238
—— spinosa 240
Galeopterus 39
—— volans 39
Galerita cristata 174, 591
—— deva 174
Gallicrex cinerea 594
Gallinago cœlestis .. 188, 596, 849
—— gallinula 188, 596
—— nemoricola 301
—— stenura 850
Gallinula chloropus 185, 594
Gallus ferrugineus 184, 619
—— macartneys 10
Gampsorhynchus rufulus rufulus .. 989
Garrulax albogularis 603, 770
—— leucolophus leucolophus .. 988
—— moniliger 988
—— pectoralis 988
Garrulus bispecularis 602, 652
—— lanceolatus 602
Gazella bennetti 842
Gecinus chlorolophus 613, 996
—— occipitalis 612, 996
—— squamatus 612
Gennæus albocristatus .. 185, 619, 775
—— batenani 848
—— horsfieldi horsfieldi 848
Geocichla citrina 994
—— wardi 609, 994
Gerardia prevostiana 584
Gerbillus 778, 779
—— andersoni 748, 749
—— cheesmani 748, 749
—— gerbillus 748, 749
—— gleadowi .. 748, 749, 779
Gerydus biggsii 1023

NUMBER.
Gerydus biggsii atomaria 1023
—— —— denticulata 1023
—— boisduvali miletus 1023
—— longeana 1023
—— symethus 1023
—— —— diopeithes 1023
Gisekia 532
—— pharnaceoides 532
Glareola lactea 186, 595
—— orientalis 595
—— pratincola 294
Glaucidium brodici 616
—— cuculoides 616
—— radiatum 616
Glossocardia 536
—— linearifolia 536
—— setosa 536
Glossonema 539
—— varians 539
Gnaphalium 534
—— pulvinatum 534
Golunda 785, 964
—— ellioti .. 782, 824, 964, 965, 1030
—— newera 964, 965
—— watsoni 965
Gomphrena 818
—— globosa 818
Gonatodes jerdoni 572, 575
Gonomys bengalensis 824
Gossypium 228
—— arboreum 228
—— herbaceum 228
Gracilea 983
—— royleana 983
—— —— plumosa 983
Graminicola bengalensis 991
Grammotoptila striata 603
—— —— striata 988
Graucalus macii 524, 992
Grewia 229
—— abutilifolia 229
—— populifolia 229
—— salvifolia 229
—— villosa 229
Grus antigone 185

NUMBER.

Grypomys 784, 801
——— gleadowi 782, 801
Gunomys 783, 787
——— bengalensis 782, 785, 787
——— gracilis 787, 788
——— kok 664, 787, 788, 1030, 1035
——— lordi 787, 788
——— varius 787, 788
——— sindicus 664, 787, 788
——— wardi 787, 788
Guyia 784, 802
——— kathleenæ 782, 802
Gymnorhis flavicollis 589, 611
Gymnosporia 233
——— montana 233
Gymnura 33
——— gymnura minor 33
Gynandropsis 221
——— pentaphylla 221
Gypaëtus 262
——— barbatus. 180, 251, 262, 616, 618
——— ——— grandis 774
Gyps 249, 255, 256, 257, 258
—— fulvus 179, 249, 250, 255, 256, 260
—— ——— himalayensis 774
—— himalayensis 249, 250, 256, 260, 616, 618
—— indicus 179, 250, 257, 287, 1045
—— tenuirostris 179, 250, 258

Hadromys 785, 964
——— humei 782, 964
Hæmatospiza sipahi 995
Hæromys 785, 964
——— chiropus 964
——— margarettæ 782
Halcyon smyrnensis 176, 591, 614, 998
Haliaëtus 1007, 1008, 1014
——— albicilla 1008, 1016
——— leucoryphus 181, 593, 617, 1007, 1008, 1014

NUMBER.

Haliastur indus 181, 593, 617, 827, 831
Haloxylon 968
——— multiflorum 968
——— recurvum 968
——— salicornicum 968
Halys dentatus 694
Hapalomys 785, 967
——— longicaudatus 782, 967
Hapalocarpum indicum 215
——— vesicatorium 215
Harpactes erythrocephalus 999
——— oresciu 859
Harpactor costalis 872
Harpiocephalus 20
——— lasyurus 21, 824
Harpiola 20
——— grisea 20
Hasora chromus 691
Helarctos 351
——— malayanus 351
Helicops schistosus 862
Helictis 346
——— nipalensis 347
——— orientalis 346, 823
——— personata 346, 347, 823
Heliotropium 541
——— calcareum 542
——— eichwaldi 542
——— ovalifolium 542
——— paniculatum 542
——— rariflorum 541
——— strigosum 543
——— supinum 541
——— tuberculosum 542
——— undulatum 542
——— zeylanicum 541
Hemianax ephippiger 874
Hemibungarus nigrescens 564, 576
Hemichelidon sibirica 607, 992
Hemichionaspis æpidistræ 622
——— theæ 623
Hemicordulia asiatica 685
Hemiechinus 31
——— auritus 748
——— collaris 32

NUMBER.
Hemiechinus megalotis 32
Hemigalus 52
———— derbianus incursor 53
Hemilecanium imbricans 625
Hemilophus pulverulentis .. 428, 613
Hemipus capitalis 426
———— picatus 992
Hemistigmoides 488
Hemitragus hylocarius 666
Hemixus flavala 990
Henicurus immaculatus 993
———— leschenaulti 993
———— maculatus 608, 993
———— schistaceus 993
Herodias alba 190, 598
———— garzetta 598, 852
Herpornis xantholeuca 989
Hesperia galba 691
Hesperoptenus tickelli 824
Heylandia 235
———— latebrosa 235
Heynea trijuga 139
Hibiscus abelmoschus 227
———— cannabinus 228
———— esculentus 227, 625
———— micranthus 227
Hieraëtus 646
———— fasciatus .. 180, 593, 616, 631, 644, 650
———— pennatus 180, 617, 631, 646, 845
Hierococcyx varius .. 177, 287, 592, 999
Himantopus candidus 187
Hipposideros armiger 823
———— fulvus 823
Hiptage madablota 871, 872
———— parviflora 871
Hirundo erythropygia 172, 995
———— guttaralis 995
———— nepalensis .. 611, 844, 995
———— rustica 172, 589, 611, 995
———— smithii 172, 589, 611, 995
———— tytleri 995
Hodgsonius phœnicuroides 424
Hoplopterus ventralis 186
Hoppea 541

NUMBER.
Hoppea dichotoma 541
Horaga 762
———— cingalensis 763
———— onyx 762, 763
———— viola 764
Hordeum 987
———— vulgare 987
Horeites brunneifrons 606
———— pallidus 772
Horornis fortipes 991
———— pallidipes 426, 991
———— pallidus 606
Houbara macqueeni 294, 861
Huphina nerissa 690
Hyæna 58
———— hyæna 58
———— striata 58
Hydranympha helvetica 157
Hydrochelidon hybrida 294, 597
Hydronympha 155
Hydrophasianus chirurgus .. 186, 595
Hydrophis cærulescens 866
———— cyanocinctus 433, 682, 864
———— gracilis 95
———— jerdoni 430
———— mamillaris 866
———— ornata 867
———— siamensis .. 682, 864, 865
———— spiralis 430
———— alcocki 430
———— bishopi 431
———— brugmansi .. 430, 431, 433, 435
———— floweri 431
———— longiceps 430, 432
———— melanocephalus 431
———— melanosoma 431
———— robusta 431
———— subcincta 430, 431
———— typica vel spiralis 431
———— tuberculatus 682, 683
———— viperina 867
Hydrus platurus 808
Hyla arborea 295
Hylomys 34
———— suillus 34

NUMBER.

Hylopetes 358
———— albo niger 358, 359
———— phayrei 358, 359
———— ———— probus .. 358, 359
———— sagitta 358
———— spadiceus 358
Hypacanthis spinoides .. 427, 611, 676
Hypolais languida 29, 860
——— pallida pallida 860
——— rama 586, 860
Hypolimnas bolina 462, 689
———— latifolium 205
———— misippus 462, 690
Hypolytrum 205
———— ——— wightianum 206
Hypothymis azurea 993
Hypsipetes psaroides .. 604, 771, 990
Hyrgrophila spinosa 625
Hystrix bengalensis 824
——— cristata 282

Ianthia rufilata 608, 994
Ianthocincla rufigularis 424, 601
———— ———— rufigularis .. 988
Ibis melanocephala 294
Icerya ægyptiaca 628
Ictinaëtus 647
———— malayensis .. 617, 631, 647
Impeyanus refulgens 321
Indigofera 237
———— anabaptista 237
———— argentea 237
———— cordifolia 236
———— houer 237
———— enneaphylla 237
———— gerardiana 695
———— linifolia 236
———— paucifolia 237
———— tinctoria 237
———— trigonelloides 236
Indothemis 734

NUMBER.

Indothemis cæsia 686, 735
———— limbata .. 734, 735, 736
Inocotis papillosus 189, 597
Iraota 438, 444, 447
——— timoleon 438
Irena puella 990
Ipomæa 546
——— aquatica 546
——— batatas 546
——— eriocarpa 546
——— obscura 546
——— palmata 546
——— pestigridis 546
——— sindica 546
Ischæmum 980
———— laxum 980
Issoria sinha 870
Ithagenes cruentus 847
Ixalus .. 562, 563, 565, 566, 567, 570, 571, 578, 579
——— variabilis 561, 563
Ixias marianne 690
—— pyrene 690
Ixos leucotis 279
Ixulus flavicollis 604
——— ——— flavicolis 989
——— occipitalis 989
Iyngipicus pygmæus 996
———— semicoronatus 996
Iynx torquilla 175, 613, 997

Jacquemontia 546
———— ——— paniculata 546
Jamides 98
——— bochus 98, 134
——— celeno 101
Jasminum 538
———— grandiflorum 697, 538
———— malabaricum 696, 697
Jatropha multifida 625
Junonia almana 689

NUMBER.
Junonia atlites 689
——— hierta 689
——— lemonias 689
——— orithyia 689
Justicia 812
——— micrantha 812
——— procumbens 813
——— simplex 812

Kallima wardi 462
Kerivoula 21
——— crypta 22
——— hardwickei 22
——— lenis 22
——— picta 21, 824
Ketupa zeylonensis 178
Kimator malacoptilus 989
Kyllinga melanosperma 312
Kyllingia 975
——— triceps 975

Lachesis anamallensis 579
——— gramineus 578
——— monticola 681
——— strigata 578
Lactuca 537
——— remotiflora 537
——— runcinata 537
Lagasca 535
——— mollis 535
Lagerstræmia microcarpa 449
Lampides 132
——— bochus 691
——— bœticus 132, 133
——— pura 103
Lanius assimilis 293, 860
——— cristatus 992
Lanius erythronotus 587, 606

NUMBER.
Lanius excubitor auchere 860
——— ——— pallidirostris 860
——— fallax 293, 860
——— isabellinus 992
——— lahtora 587, 667
——— nigriceps 675, 992
——— tephronotus 992
——— vittatus 587, 606
Laphophorus ipejanus 321
Laponaria 224
Laranthus elasticus 469
Larus ridibundus 188
Larvivora brunnea 604
Lathrecista 146, 147
——— asiatica 146, 148
——— ——— ——— asiatica 147
——— pectoralis 147
——— simularis 147
——— terminalis 147
Laticilla burnesi 586
Latipes 979
——— senegalensis 979
Launæa 538
——— chondrilloides 538
——— nudicaulis 538
Launea secunda 696
Lawsonia 527
——— alba 628
——— inermis 527
Lecanium hemisphæricum 625
——— nigrum 625
——— oleæ 625
——— viride 625
Leea sambucina 953
Leggada 419, 420, 421, 784, 959
——— albidiventris 959
——— beavani 959
——— booduga 420, 782, 959, 960, 961, 1029, 1034
——— cervicolor 959
——— cookii 420, 960, 961
——— cunicularis 965
——— darjilingensis 959
——— dunni 960
——— famula 1031, 1034

NUMBER.

Leggada famulus 420, 959, 960, 961
——— fulvidiventris 959
——— lepidus 959
——— nitidula nitidula 962
——— popæa 420, 962
——— ——— nitidulus 420, 959, 966
——— pahari 420, 960, 961
——— popœus 960
——— strophiatus 959
——— terricolor 959
Leggadilla 784, 955
——— bahadur .. 955, 956, 957
——— cinderella 955, 956
——— grahami 955, 956, 957, 1034
——— gurkha .. 955, 956, 957
——— hannyngtoni .. 955, 956, 957
——— phillipsi .. 955, 956, 957
——— platythrix .. 782, 801, 955, 956, 1029
——— ramnadensis .. 955, 956, 957
——— sadhu 955, 956
——— shortridgei .. 955, 956, 957
——— siva 955, 956, 957
——— surkha .. 955, 956, 957
Lepas anserifera 809
Lepidagathis 812
——— cristata 812
——— trinervis 812
Leptadenia 540
——— spartium .. 222, 234, 540
Leptetrum quadrimaculata 150
Lepthemis divisa 167
——— sabina 167
——— trinacria 158
Leptopilus javanicus 859
Leptosia xyphia 461, 690
Lepus hispidus 825
——— nigricollis 1030, 1035
——— ruficaudatus 824
Lethe vaivarta 870
Leucæna glauca 246
Leucas 814
——— aspera 814
——— cephalotes 814
——— nutans 814

NUMBER.

Leucas stricta 814
——— urticæfolia 814
Leycesteria formosa 695
Libella 155
——— anceps 161
——— brunnea 159
——— cærulescens 159
——— cancellata 157
——— deleserti 164
——— glauca 166
——— luzonica 163
——— neglecta 170
——— petalura 170
——— pruinosa cletia 170
——— ransonnetti 162
——— sabina 167
——— testacea 169
——— triangularis 164
——— trinacria 158
Libellula 144, 147, 149, 488
——— ampullacea 167
——— anceps 160, 161
——— annulata 923
——— apicalis 509
——— asiatica 147
——— aurora 920
——— braminea 503
——— bremii 158
——— brunnea 159
——— cæsia 735
——— cancellata 157
——— carnatica 925
——— celestina 930
——— clathrata 158
——— congener 145
——— conspurcata 151
——— contaminata 739
——— cyprica 925
——— equestris 510
——— erythæa 517
——— erythroneura 497
——— ferruginata 151, 517
——— ferruginea 516, 517
——— festiva 925
——— flaveola 497

NUMBER.

Libellula fluctuans 513
—— fonscolombei 497
—— frumenti 157
—— fulva 151
—— fulvia 509
—— geminata 514
—— gibba 167
—— glauca 166
—— gracilis 162
—— histrio 930
—— hæmatina 923
—— indica 930
—— infernalis 925
—— intermedia 511
—— leptura 167
—— lineata 510
—— maculata 150
—— macrocephala 495
—— marcia 930
—— murcia 930
—— nebulosa 501
—— neglecta 170
—— oblita 505
—— obscura 145
—— obsoleta 923
—— pectoralis 147
—— pentica 151
—— petalura 170
—— phyllis 931
—— pruinosa 170
—— quadrimaculata .. 149, 150
—— quadripunctata .. 150, 931
—— ramburii 161
—— ransonnetti 162
—— rubra 517
—— rubrinervis 923
—— rufa 505
—— ruficollis 495
—— sabina 167
—— secula 495
—— servilia 516
—— sexmaculata 489
—— sobrina 491
—— sophronia 509
—— soror 516

NUMBER.

Libellula striolata 495
—— ternaria 151
—— testacea 168
—— tæniolata 160
—— trinacria 158
—— trivialis 503
—— truncatula 739
—— tullia 510
—— variegata 930
—— victoria 517
—— vittata 931
—— vulgata 495
Libythia hauxwelli 1022
—— lepita 1022
—— myrrha 1022
—— rohini 1022
Limeum 532
—— indicum 532
Limnanthemum 541
—— parvifolium .. 219, 541
Limonidromus indicus 428, 995
Limotes octolineatus 580
Lindenbergia 550
—— abyssinica 550
—— urcicæfolia 550
—— urticæfolia 550
Linum 230
—— usitatissimum 230
Liopicus mahrattensis 175
Lioptila capistrata 604
—— —— capistrata 989
—— —— pallida 771
Liothrix lutea 425, 604, 675
Lipocarpha 204
Lippia 813
—— argentea 204
—— nodiflora 813
—— sphacelata 204
Lochnera rosea 539
Locustella straminea 605, 991
Loganias marmorata 1022
—— —— watsoniana ..1022
—— massalia 1022
Loipicus mahrattensis 591
Lophoceros birostris ..176, 591, 614, 998

NUMBER.
Lophophanes dichrous 603
——————-- melanolophus 603
——————— rufinuchalis 603
Lophophorus 319
——————- chambanus 321
——————— impejanus .. 319, 320, 321
———————— ————-- mantoni .. 321
———————— ————-- obscurus .. 321
——————— l'huysii .. 319, 320, 335, 337
——————— refulgens 320, 619
——————— sclateri .. 319, 320, 331
Lophoshoros wallichi 2
Lophura 9
———-— diardi 15
———-— rufa 10, 11
———-— sumatrana 11
———-- vieilloti 11
Loranthus 123, 622
————- elasticus 465
————— longiflorus 472
————— scurrula 467
Loriculus vernalis 999
Loris lydekkerianus 836
Loxia himalayana 610
Loxura 764
——— atymnus 764
Luffa 528
——- acutangula 528
——- ægyptiaca 528
Lusciniola melanopagon 182
Lutra 348, 349
——- aurobrunnea 348
——- ellioti 348
——- lutra 349, 823, 1032
——- macrodus 823
——- tarayensis 349
——- vulgaris 348
Lycium 548
——— barbarum 548
Lycodon aulicus 565
———-- jara 580
————— travancoricus 565, 567
Lycopersicum 549
——————— esculentum 549
Lygosoma .. .. .565, 566, 571, 573, 579

NUMBER.
Lyriothemis 141
——————- acigastra .. 141, 142, 144
——————- cleis .. 141, 143, 144
Lyroderma lyra lyra 823
Lythrum triflorum 216

Mabuia 565, 566, 573
Macaca assamensis 822
————- pelops 822
————- rhesus 822
————- sinica 1031
Machlolophus xanthogenys 603
Macrogomphus annulatus 875
Macropisthodon plumbicolor 563, 566, 567
Macropteryx coronata 999
Macropygia ruficeps 859
Mahathala 443
—————-- ameria 443
Malacocinla abbotti 989
Mangifera 235
————— indica 235
Manis aurita 825
————-- crassicaudata 825
Mareca penelope 191, 842
Marmaronetta angustirostris 674
Marmota 776
———— caudata 776, 777
———— caudatus 776
———— dichrous 777
———— himalayana 776, 777
———— himalayanus 776
———— hodgsoni 776
———— littledalei 777
———— stirlingi 776, 777
Martes 343
———— flavigula 343, 344, 823
———— ————-- flavigula 343
———— ————— peninsularis .. 343, 344
———— foina 343

NUMBER.

Martes gentilis .. 421
——— gwatkinsi .. 343, 344
——— toufæus .. 343, 344
Mazus surculosus .. 696
Medicago .. 236
——— laciniata .. 236
Megalæma marshallorum .. 613, 997
Megalurus palustris .. 991
Melanitis ismene .. 689
Melanochlora sultanea .. 990
Melanocorypha bimaculata .. 174
Melanophidium punctatum .. 584
——— wynadense .. 560, 576
Melanoschistus .. 618
Meleagris satyra .. 707
Melhania .. 228
——— denhami .. 228
——— hamiltoniana .. 229
——— magnifolia .. 228
——— tomentosa .. 228
Melittophagus swinhœi .. 998
Mellivora .. 347
——— indica .. 347, 1027
Melophus melanicterus .. 611, 995
Melothria .. 529
——— heterophylla .. 529
——— leiosperma .. 529
——— madraspatana .. 529
——— perpusilla .. 529
Melursus .. 351
——— ursinus .. 351, 659, 823, 841, 1033
Menetes .. 377
——— berdmorei .. 377, 378
——— ——— decoratus .. 377, 378
Meriones .. 726, 779
——— ambrosius .. 935
——— erythrourus .. 779, 780
——— hurrianœ .. 726, 779, 780
——— persicus baptistæ .. 934
Merops philippinus .. 591, 613, 997
——— viridis 176, 293, 591, 613, 844, 997
Merremia .. 546
——— ægyptia .. 546
Merula albicincta .. 608
——— atrigularis .. 609, 994

NUMBER

Merula boulboul .. 609, 994
——— castanea .. 609
——— fuscata .. 994
——— unicolor .. 609
Metoponia pusilla .. 610
Microcichla scouleri .. 608
Micromys .. 785, 967
——— agilis .. 782
——— erythrotis .. 967
Micropternus brachyurus .. 858
——— phæoceps .. 996
Micropus melanocephalus .. 856
Microthemis .. 490
Millardia .. 784, 801
——— dunni .. 801, 802
——— listoni .. 801
——— meltada .. 664, 782, 801
——— ——— listoni .. 802
——— ——— meltada 802, 1030, 1035
——— pallidior .. 801, 802
Milvus govinda .. 181, 593, 617, 774, 827
——— ——— melanotis .. 827, 830
——— migrans .. 826, 827, 831, 845
Mimosa .. 245
——— hamata .. 245
——— rubicaulis .. 245
Miniopterus .. 22
——— fuliginosus .. 22
——— pusillus .. 22
Minla igneitincta .. 990
Mirafra assamica .. 995
——— cantillans .. 174, 590
——— erythroptera .. 174
Mitragyna .. 532
——— parvifolia .. 532
Mixornis gularis .. 855
——— rubricapillus .. 855
Mollugo .. 531
——— cerviana .. 531
——— hirta .. 531
——— nudicaulis .. 531
Molpastes bengalensis .. 990
——— hæmorrhous .. 523, 586
——— intermedius .. 605
——— leucogenys .. 286, 605, 614, 990

Number.
Momordica 527
—— balsamina 528
—— charantia 527
—— dioica 528
Monomorium speculare 114
Monophlebus tamarindus 628
Monsonia 231
—— heliotropioides 232
—— senegalensis 231
Montifringilla nemoricola altaica .. 773
Morina persica 695
Moringa 235
—— concanensis 235
—— pterygosperma 235
Morus 972
—— alba 972
Moschiola meminna 1030
Motacilla alba 172, 589, 611, 995
—— beema 173, 589
—— borealis .. 173, 589, 995
—— citreola .. 173, 612, 995
—— citreoloides 173
—— hodgsoni 995
—— luzionensis 172
—— madraspatensis 172, 611, 995
—— melanope .. 173, 612, 995
—— personata .. 172, 589, 611
Mungos 53
—— auropunctatus 54, 56
—— —— auropunctatus .. 822
—— —— helvus .. 55, 56
—— —— pallipes .. 55, 56
—— birmanicus 54, 55, 56
—— flavidens 55, 57
—— fuscus 54, 55, 57
—— fulvescens 54
—— lanka 55, 57
—— mungo 54, 660
—— —— ellioti 55, 57, 1032
—— —— ferrugineus .. 55, 56
—— —— mœrens ..55, 57, 1027
—— —— mungo 55, 56, 823
—— —— pallens 57
—— nipalensis 55, 56
—— pallens 55

Number.
Mungos smithii 54, 55, 57, 1027
—— urva 54, 55, 58, 823
—— vitticollis .. 54, 55, 58, 1032
Munia atricapilla 994
Muntiacus vaginalis 825
Murina 19
—— aurata 20
—— cyclotis 20
—— huttoni 20
—— rubex 20
—— tubinaris 20
Mus 419, 784, 957
—— abbotti 421
—— æquicaudalis 958
—— alexandrinus .. 63, 64, 412, 1029
—— algirus 420
—— bactrianus 420, 421, 958
—— booduga 824
—— dubius .. 824, 958, 959, 1028
—— famulus 1034
—— færensis 420
—— gentilis 420, 421
—— gerbillinus 958
—— homourus 958
—— kakhyensis 958
—— kandianus 387
—— manei 958
—— muralis 420
—— musculus .. 420, 421, 782, 958, 1028
—— nemoralis 408
—— nitidus 412
—— rattus 63, 64, 412, 1029
—— robustulus 400
—— rufescens 403, 404
—— spicilegus 420, 421
—— tectorum 63
—— theobaldi 958
—— tytleri 958
—— urbanus 958, 1028, 1033
—— viculorum 958
—— wagneri 420
Muscicapa griseola 588
Mustela 345
—— alpinus 345

NUMBER.
Mustela canigula 345, 346
——— erminea 345
——— kathiah 345, 346
——— longstaffi 345, 346
——— strigidorsa 345
——— subhemachalana 345
——— temon 345, 346
——— whiteheadi 345
Mycalesis perseus 689
——— visala 870
Myiophoneus temmincki .. 604, 989
——— ——— timminckii .. 773
Myotis emarginatus 933
——— lanceus 933
——— muricola 824
Myriapoda 303
Mytilaspis piperis 623

Naia 973
—— australis 974
—— bungarus 575
—— graminea 973
—— tripudians 575
—— welwitschii 974
Nectogale 38
——— elegans 38
——— sikhimensis 39
Neophron 261
——— gingianus 180, 249, 250, 261, 616
——— percnopterus ..180, 249, 251, 261, 593, 774
Neornis flavolivaceus 425
Neptis eurynome 689
——— mahendra 870
——— narayana 870
Nerium odorum 307
——— oleander 307
Nesala 215
——— brevipes 216
——— capitellata 216
——— lanceolata 216
——— triflora 216

NUMBER.
Nesokia 783, 789
——— beaba 789, 790
——— buxtoni 422, 423
——— griffithi 789
——— huttoni 423, 789
——— indica 422, 782, 789
Nesoxenia lineata 154
——— metallica 153
Nethapus coromandelianus 674
Netta rufina 842
Nettium crecca 191
Nettopus coromandelianus 842
——— coromandus 598
Neurada 525
——— procumbens 525
Neurothemis 506
——— ceylanica 513
——— equestris 510
——— fluctuans 508, 513
——— ——— apicalis 513
——— fulvia .. 506, 507, 508, 509
——— intermedia .. 506, 511, 512
——— ——— degener 508, 512
——— ——— intermedia 508, 511
——— nicobarica 513
——— palliata 513
——— pedestris 510
——— septentrionis 512
——— sophronia 509
——— stigmatizans 513
——— terminata 508, 513
——— tullia feralis .. 508, 511
——— ——— tullia .. 507, 510, 511
Nicotiana 548
——— tabacum 548
Niltava macgrigoriæ 993
——— sundara 607, 993
Nimachilus marmorata 295
Nitidula hodgsoni 993
Nothosærua 817
——— brachiata 817
Notodela leucura 994
Nucifraga caryocatactes hemispila .. 770
——— hemispila 602
Numenius arquata 187, 596

NUMBER.
Nycticorax griseus 190, 598
Nyctinomus tragata 731, 1026
Nyctiornis amictus 858
——— athertoni 998
Nymphaea 219
——— lotus 219
Nyroca africana 290, 842
——— ferina 191, 842
——— fuligula 191

Ochotona rufescens 937
——— regina 937
——— vizier 937, 938
——— vulturna 937, 938
Ocimum 814
——— basilicum 814
——— canum 814
——— sanctum 625, 814
Odina odiar 627
Œcophylla smaragdina .. 449, 456, 766
Œdicnemus scolopax 186, 294
Œnanthe chrysopygia 860
——— cummingi 860
——— xanthoprymma 860
Œnopopelia tranquebarica 184, 594, 1044
Œnothera rosea 695
Olax wightiana 446
Oldenlandia 532
——— aspera 532
Olea dioica 462
Oligodon affinis 568
——— subgriseus 568
——— venustus 567
Oligura castaneicoronata .. 425, 989
Onychothemis 742
——— tonkinensis ceylanica 742, 743
Opisthius indicus 848
Opuntia 530
——— dillenii 530
——— monacantha 626

NUMBER.
Oreicola ferrea 608, 993
——— jerdoni 993
Orenius sinuatus.. 295
Oreocincla dauma .. 427, 676, 994
——— mollissima 427
Oreocorys sylvanus .. 174, 612, 774
Orinoma damaris 870
Oriolus kundoo 587, 607
——— luteolus 992
——— tenuirostris 992
——— trailii 992
Orogomphus xantheptera 874
Oropetium 987
——— thomæum 987
Orthemis lineata 153
——— metallica 153
Orthetrum 144, 147, 154, 155
——— anceps .. 154, 156, 161
——— asiatica 147
——— brevistylum 160
——— brunneum 156
——— ——— brunneum .. 159
——— cancellatum 156
——— ——— cancellatum .. 157
——— carnaticum 164
——— chrysis 157, 169
——— chrysostigma .. 154, 155, 156, 163
——— ——— luzonicum .. 163
——— congener 145
——— deleserti 164
——— divisum 167
——— glaucum .. 156, 165, 166
——— gracilis 162
——— hyalinum 160
——— internum 157
——— japonicum 154, 156
——— ——— internum 157
——— leptura 167
——— lepturum 167
——— luzonica 163
——— neglecta 170
——— nicèvillei 166
——— oblitum 505
——— obscura 145
——— petalura 170

Number.

Orthetrum pruinosum .. 157, 165, 170
——— ——— ceylanicum .. 170
——— ——— neglectum .. 170
——— ramburii 161
——— ransonnetti .. 154, 156, 162
——— sabina .. 154, 155, 156, 167, 686, 688
——— sabinum 167
——— testacea 169
——— testaceum 156, 168
——— ——— testaceum .. 168
——— tæniolatum .. 154, 156, 160
——— triangulare 156, 165
——— ——— triangulare .. 164
——— trinacri 156, 158
——— tricolor 163
Orthotomus atrigularis 991
——— sutorius .. 586, 605, 991
Orygia 531
——— decumbens 531
Oryx beatrix 283
——— leucoryx 283
Osonius belbei 848
Otis tetrax 861
Otocompsa emeria 990
——— flaviventris 990
Otogyps 253
——— calvus .. 179, 249, 250, 253, 260, 593, 616, 774
Otomops 27
——— wroughtoni 27
Ougeinia dalbergioides 139
Oxalis 232
——— corniculata 232
Oxystelma 539
——— esculentum 539

Pachyura 37, 823, 1031
——— bidiana 37
——— blanfordi 1026
——— cærulea 37
——— davi 37

Number.

Pachyura hodgsoni 37, 823
——— leucogemys 37
——— murina 37
——— perrotteti 37, 1026
——— rubicunda 37
Paguma 50
——— grayi 50
——— ——— grayi 51, 52
——— ——— wroughtoni 52
——— larvata intrudens .. 51, 52
——— leucomystax robusta 51
——— tytleri 51
Palæornis cyanocephalus 177, 592, 615, 999
——— faciatus 999
——— indoburmanicus 999
——— nepalensis .. 177, 592, 999
——— rosa 999
——— schisticeps 615
——— torquatus .. 177, 178, 592, 615, 999
Palpopleura 488
——— sexmaculata 489
Palumbus casiotis 618
——— palumbus 294
Pandion 251
——— haliaëtus .. 178, 250, 251, 593
Panicum 977
——— antidotale 978
——— colonum 977
——— crus-galli 978
——— fluitans 977
——— psilopedium 978
——— rumosum 977
——— trypheron 977
——— turgidum 977
Pantala flavescens 686, 687
Papaver 219
——— somniferum 219
Papilio aristolochiæ 690
——— cashmirensis 870
——— centaurus 447, 453
——— clytia 690
——— daksha 461
——— demolius 690
——— nomius 690

NUMBER.

Papilio polymnestor 461
——— polytes 690
——— tamilana 461
Paplidium 549
———— humifusum 549
Pappophorum 985
———— aucheri 985
———— elegans 985
———— robustum 985
Paradoxornis flavirostris 988
Paradoxurus 48
———— aureus 49, 50
———— birmanicus .. 49, 50
———— crossi 49, 822
———— hermaphroditus 48
———— jerdoni 49, 50
———— niger .. 48, 49, 1027
———— ravus 49, 50
———— strictus 49, 50, 822
Paraechinus 32
———— blanfordi 33
———— dorsalis 748
———— ludlowi 748
———— macracanthus 33
———— micropus 33
———— nudiventris 33
Parapolybia orientalis 693
Parascaptor 35
———— leucurus 35
Pareba vesta 1022
———— anomala 1022
———— sordica 1022
Pareronia hippia 690
Parkinsonia 244
———— aculeata 244
Parnara mathias 691
Parus arenarius 602
—— atriceps 602, 770, 988
—— melanolophus 770
—— monticola 602, 988
—— monticolus monticolus 770
Passer cinnamomeus 611, 995
——— domesticus .. 293, 589, 611, 995
———— indica 773
——— hispaniolensis 293, 676

NUMBER.

Passer montanus 995
——— pyrrhonotus 589
——— rutilans debilis 773
Pastor roseus 293, 587, 853
Pavo cristatus 184, 594, 619, 775
——— muticus 673
Pavonia 227
——— arabica 227
——— odorata 227
——— zeylanica 227
Peganum 231
———— harmala 231
Pegolettia 534
———— senegalensis 534
Pelargopsis gurial 997, 998
Pelecanus 597
Pellorneum mandellii 424
———— ruficeps mandellii 989
Penelope satyra 707
Pennisetum 978
———— cenchroides 978
———— ———— echinoides .. 979
———— prieurii 979
———— typhoideum 241, 978
Pentatropis 540
———— cynanchoides 540
Penthocoryx sonnerati 615, 999
Perdicula asiatica 185, 619
Pericrocotus brevirostris .. 606, 772, 992
———— erythropygius 587
———— peregrinus 587, 992
———— roseus 607, 992
———— solaris 992
———— speciosus 992
Periploca 539
——— aphylla 539
Peristrophe 813
———— bicalyculata 813
Pernis 1003
——— cristatus .. 181, 593, 827, 1003
——— perotis 980
Petaurista 354
———— albiventer 355, 357
———— berrelli 355, 356
———— candidulus 355, 356

Number.

Petaurista caniceps 354, 355, 357
——— cinderella 354, 355
——— cineraceus 354, 355
——— fulvinus 355, 357
——— inornatus 354, 355, 356
——— lanka 354, 356
——— lylei venningi 354, 356
——— magnificus 354
——— nobilis 355, 356
——— oral 354, 355
——— philippensis 354, 356, 1033
——— punctatus 354
——— sybilla 355, 357
——— taylori 355, 356
——— yunnanensis 354
Petinomys 359
——— fuscicapillus 359, 360
——— layardi 359, 360
——— phipsoni 359, 360
Petrophila cinclorhyncha 609
——— cyanus 609, 994
——— erythrogastra 609, 994
——— solitaria 994
Peucedanum 532
——— graveolens 532
Phalacrocorax carbo 189, 620
——— javanicus 189, 597
Phaseolus 241
——— aconitifolius 241
——— mungo 241, 242
——— radiatus 241
——— trilobus 241
Phasianus bengalensis cornutus 706
——— castaneus 10
——— cornutus 707
——— curvirostris 320
——— elegans 673
——— ignitus 10
——— impejanus 320
——— melanocephalus 707, 885
——— nepaulensis 707
——— rufus 10
——— satyrus 707
——— stacei 2
——— wallichi 1

Number.

Phenacoccus iceryoides 627
——— insolitus 626
Phœnicopterus roseus 853
Phœnicurus cæruleocephala 773
——— frontalis 773
Phœnix dactylifera 306
——— sylvestris 306
Phyllanthus 971
——— madraspatensis 971
——— nirurii 971
Phyllergates coronatus 991
Phylloscopus affinis 605, 675
——— collybita tristis 772
——— fuliginiventris 991
——— fuscatus 991
——— humii 606
——— indicus 772
——— maculipennis 606
——— numii 587
——— proregulus 606
——— newtoni 772
——— pulcher 606, 991
——— subviridis 606
——— superciliosus humii 772
——— tristis 605, 991
——— tytleri 605
Physalis 548
——— minima 548
——— peruviana 548
Picumnus innominatus 613, 997
Pieris brassicæ 869
Pinus exelsa 604
——— longifolia 604, 770
Pipistrellus babu 823
——— coromandra 823, 1026, 1031
——— coxi 747
——— fuscipes 747
——— mimus 1026
——— ——— mimus 824
——— nigripes 747
——— rüppelle 747
Piprisoma squalidum 175, 591
Pithecolobium 246
——— dulce 246
Pithecus entellus 822

NUMBER.

Pitta brachyura 428, 996
—— cucullata 996
—— nepalensis 996
Platacanthomys 778
—— lasiurus 778
—— leucorodia 189
Platanista gengetica 825
Plalysmurus leucopterus 854
Plectrurus davisoni 558
—— perroteti 558, 576, 578
Ploccella javanensis 670
Ploceus atrigula 994
—— begalensis 676
—— megarhynchus 994
Plotus melonogaster 597, 997
Pluchea 533
—— lanceolata 533
Plumeria acutifolia 625
Plumieria acutifolia 539
Pnœpyga pusilla 991
—— squamata 425, 605
Podicipes albipennis 191, 598
Poinciana 244
—— elata 244
Polioaëtus 1007, 1008, 1017
—— humilis 1009, 1018
—— ichthyaëtus 1009, 1017
Polycarpæa 224
—— corymbosa 224
Polygala 223
—— abyssinica 224, 695
—— erioptera 223
—— irregularis 223
Polygonum 969
—— plebejum 969
—— —— indica 969
Polyneura apricalis 513
—— elegans 513
—— fulvia 509
—— sophronia 509
Polyodontophis collaris 862
—— subpunctatus 584
Polyommatus bœticus 691
Pomatorhinus erythrogenys 603
—— —— erythrogenys 771, 989

NUMBER.

Pomatorhinus olivaceus 855
—— schisticeps schisticeps 988
Pongamea 244
—— glabra 139, 244
Porocephalus crotali 559
Portulaca 224
—— oleracea 224
—— quadrifida 224
Porzana pusilla 594, 620
Potamogeton 973
—— crispus 973
—— natans 973
—— pectinatus 973
Potomarcha 144
—— congener 145
—— obscura 145, 686
Pratapa 457, 464
—— deva 464, 435, 467
Pratincola caprata 588, 608, 843, 993
—— insignis 993
—— leucura 993
—— maura 588, 608, 993
Prenolepis 132
—— longicornis 114
Primula floribunda 696
Prinia blanfordi 1043
—— flaviventris 675, 991
—— inornata 587, 992, 1042, 1043
—— lepida 587
—— socialis 587, 991, 1043
—— sylvatica 991
Prionodon 47
—— maculosus 47, 48
—— pardicolor 47, 48, 822
Progasser rhodochrous 610
Proparus vinipectus 604
Prosopis 245
—— spicigera 245
Protorthemis lineata 154
—— metallica 153
Prunella atrogularis 773
—— strophiatus jerdoni 773
Psarisomus dalhousiæ 858, 996
Psaroglossa spiloptera 604, 990
Pseudococcus citri 626

NUMBER.
Pseudococcus corymbatus 626
——— sacchari 626
——— virgatus 626
Pseudogyps 249, 258
——— bengalensis .. 179, 249, 250, 258, 260, 287, 593, 616, 660, 774
Pseudotantalus leucocephalus 597
Psidium L 526
——— guyava 526
Psittiparus gularis gularis 988
——— ruficeps 988
Psoralea odorata 238
——— plicata 238
Pterocarpus marsupium 457
Pterocles alchata 672, 673
——— alchata caudaota 861
——— arenarius .. 184, 294, 672
——— exustus 672
——— fasciatus 184, 672
——— lichtensteini 672
——— senegallus 672, 673
Pteroclurus alchata 294
——— exustus .. 184, 294, 594
Pteromys 358
——— alboniger 824
——— (Hylopetēs) alboniger .. 359
——— ——— belone 359
——— ——— phayrei 359
——— ——— ——— probus .. 359
——— ——— spadiceus 359
——— inornatus 634
Pteropus giganteus giganteus .. 823, 1025
Pteruthius erythropterus .. 604, 989
——— xanthochloris 604
Ptyonoprogne rupestris 611
Pucrasia macrolophus 619, 775
Pulicaria 534
——— augustifolia 534
——— crispa 534
——— rajputanæ 535
——— wightiana 534
Pulvinaria maxima 624
——— psidii 624
——— thespesiæ 624
Punica 527

NUMBER.
Punica granatum 527
Pupalia 818
——— lappacea 818
——— ——— velutina 818
——— arbiculata 818
Putorius 344
——— larvatus 344
Pycnonotus finlaysoni 856
——— leucogenys 771
——— leucotis leucotis 279
——— ——— mesopotamia .. 279
——— analis 856
Pycnorhamphus icteroides 610
Pyctorhis altirostris griseigularis .. 989
——— sinensis 585
——— ——— sinensis 989
Pyromys 784, 801
——— priestleyi 782, 801
Pyrrhopicus pyrrhotis 996
Pyrrhula erythrocephala 610
——— nepalensis 427, 610
Pyrrhulauda grisea 174, 591
Python molurus 862, 864

Quercus semiserrato 301
Querquedula circia 191, 620
Quisqualis indica 945, 948

Rallina superciliaris 429
Rallus aquaticus 185
Rathinda 754
——— amor 755, 758, 763
Ratufa 360
——— bicolor 360
——— indicus 360
Rana esculenta 295

NUMBER.

Rana limnocharis 562, 570
—— temporalis 562
Ranunculus lætus 695
Rapala 941
—— melampus 941
—— schistacea .. 942, 943, 948
—— varuna 945
Raphanus sativus 220
Rattus 784
—— andamanensis 791, 792
—— berdmorei .. 790, 791, 798
—— —— mullulus .. 790, 791
—— blanfordi 790, 791, 798, 1030
—— bowersi 790, 791, 798
—— concolor 790, 791, 797
—— decumanus 790
—— eha 790, 792, 799
—— fellii 361, 363
—— feæ 790, 791
—— fulvescens .. 790, 792, 799
—— girensis 403, 408
—— jerdoni 790
—— kandianus 408, 411
—— kelaarti .. 62, 411, 412, 793, 795
—— lepcha 790, 792, 799
—— listeri 790, 791, 798
—— mackenziei .. 790, 791, 797
—— —— feæ 798
—— macmillani 61, 398, 400, 409, 410, 793, 795
—— manipulus .. 790, 791, 797
—— mentosus 410, 790, 792, 799
—— nitidus .. 411, 412, 415, 416, 591
—— —— nitidus .. 60, 793, 795
—— —— obsoletus ..60, 792, 795
—— niviventer .. 790, 792, 799
—— norvegicus 63
—— rattus 56, 63, 392, 397, 400, 403, 404, 410, 411, 412, 414, 782, 790, 791, 792
—— —— alexandrinus 63, 64, 408, 409, 794, 797, 1029
—— —— arboreus 62, 74, 794, 796
—— —— bhotia 61, 72, 397, 398, 793, 796, 824

NUMBER.

Rattus rattus frugivorus 65
—— —— gangutrianus 61, 389, 408, 793, 796
—— —— girensis .. 62, 83, 794, 797
—— —— kandianus .. 62, 387, 388, 794, 796
—— —— khyensis .. 60, 398, 400, 401, 793, 795
—— —— narbadæ 62, 77, 403, 408, 411, 794, 796
—— —— nemoralis 63, 408, 794, 797
—— —— obsoletus 415, 416
—— —— rattus .. 63, 64, 794, 797
—— —— rufescens.. 63, 403, 408, 794, 797, 1029, 1035
—— —— sataræ 61, 87, 405, 794, 796
—— —— sikkimensis 61, 394, 793, 795
—— —— tatkonensis 60, 398, 400, 402, 793, 795
—— —— tikos .. 61, 400, 793, 795
—— —— tistæ 61, 68, 391, 395, 793, 796
—— —— wroughtoni 62, 384, 388, 794, 796, 1034
—— rogersi 791, 798
—— rufescens 407, 415
—— surifer 790, 792, 799
—— validus 791, 792
—— vicerex .. 59, 60, 408, 790, 791
—— vociferans.. .. 790, 792, 798
Ratufa dealbata 360, 361
—— fellii 361, 363
—— gigantea 361
—— —— gigantea .. 362, 824
—— —— lutrina 361, 362
—— indica bengalensis .. 360, 362
—— —— centralis .. 360, 362, 1033
—— —— indica 360, 361
—— —— maxima 361, 362
—— —— superans 360, 361
—— macroura 361
—— —— dandolena .. 361, 362
—— —— macroura 362
—— —— melanochra .. 361, 362
—— phœopepla marana .. 361, 363
—— —— phœopepla .. 361, 363

Number.

Regulus cristatus 605
——— regulus himalayensis 772
Remirea 204
——— maritima 204
Rhabdops olivaceus 564
Rhacophorus maculatus 681
Rhinoceros unicornis 825
——— sondaicus 825
——— sumatrensis 825
Rhinolophus affinis himalayanus .. 823
Rhinophis sanguineus 557, 573
Rhinopoma 25
——— hardwickei 26
——— kinneari 26
——— muscatellum seianum .. 26
Rhipidura albicollis 608, 993
——— albifrontata 588, 993
Rhizomys castaneus 824
Rhizothera dulitensis 292
——— longirostris 291, 292
Rhodonessa caryophyllacea 190
Rhodothemis 504
——— rufa 504, 505
Rhopodytes tristis 999
Rhus 235
——— mysorensis 235
Rhyacornis fuliginosus 608, 994
Rhynchops albicollis 188, 597
Rhynchosia 242
——— arenaria 243
——— minima 242
——— rhombifolia 242
Rhynchostylis retusa 486
Rhyncospora 205
——— aurea 205
——— wallichiana 205
——— wightiana 205
Rhyothemis 928
——— marcia 930
——— murcia 930
——— phyllis 686
——— phyllis phyllis. 929, 931, 932
——— plutonia 929
——— triangularis 930
——— varieagata 686, 929

Number

Rhyothemis variegata variegata. 930, 931
Rhytidoceros subruficollis 858
——— undulatus .. 858, 998
Ricinus 971
——— communis 971
Riparia rupestris 714
Ripersia sacchari 627
Rivea 547
——— hypocrateriformis 547
Rostratula capensis 596
Rousettus leschenaulti 823
Rucervus duvauceli 825
Ruellia 811
——— patula 811
Rusa equinus 841
——— unicolor 825
Ruticilla aurorea.. 993
——— frontalis 608
——— hodgsoni 994
——— rufiventris .. 289, 588, 608, 994

Saccharum 980
——— officinale 980
——— spontaneum 980
Saccolaimus 25
——— saccolaimus 25
Salacea macrosperma 953
Salea horsfieldi 570
Salsola 969
——— fœtida 969
Salvadora 538
——— olevides 539
——— persica 538
Salvia 814
——— ægyptiaca 814
——— pumila 814
Sapindus trifoliatus 769, 948
Saponaria vaccaria 224
Saraca indica 951
Sarcidiornis melanonotus 842
Sarciophorus malabaricus .. 186, 59

Number.

Sarcogrammus indicus .. 186, 590, 596, 620
Sarcostemma 540
—— brevistigma 540
Sasia ochracea 997
Satyra (Tragopan) alpnis 707
—— lathami 707
—— melanocephala 885
—— nepaulensis 707
—— pennanti 707
—— satyra 707
—— temminckii 901
Satyrus cornutus 707
Saxicola capistrata 588
—— chrysopgia 608
—— isabellina 588
—— mœsta 860
—— picata 588
Schizothorax esocinus 295
—— intermedius 295
Schœniparus rufigularis 989
Schweinfurthia 549
—— sphœrocarpa 549
Scirpus 200, 976
—— articulatus 200, 201
—— corymbosus 200, 201
—— erectus 200, 201
—— grossus 200, 202, 976
—— kyllingoides boeck 202
—— kysoor 200, 202
—— litoralis 200, 202, 976
—— maritimus .. 200, 202, 976
—— michelianus 200, 202
—— mucronatus 200, 201
—— quinquefarius .. 200, 201, 976
—— squarrosus 200, 202
—— supinus 200, 201, 976
Sciurus lokriah 824
Scleria 206
—— annularis 207
—— biflora 207
—— caricina 206
—— elata 208
—— hebecarpa 207
—— lithosperma 206
—— stocksiana 208

Number.

Scleria tessellata 207
Scolopax rusticola 620
Scolopendra morsitans 303
Scops giu 178
—— spilocephalus 615
Scotocerea inquieta 293, 860
Scotomanes ornatus 824
Scotophilus kuhli .. 824, 1026, 1031
—— wroughtoni 824, 1026
Scotozous dormeri dormeri 824
Scutellaria scandens 696
Sedum adenotrichum 695
Seetzenia 231
—— orientalis 231
Senecio nudicaulis 696
Sericostoma 543
—— pauciflorum 543
Serilophus lunatus 857
—— rubripygius 996
Sesamum 551
—— indiqum 551
Sesbania 240
—— aculeata 240
Setaria 978
—— verticillata 978
Sibia picaoides picaoides 989
Sida 225
—— cordifolia 226, 627
—— grewioides 226
—— spinosa 225
Silybura brevis 558, 576
—— ocellata 557, 576
Simotes beddomi 581
—— splendidus 580
—— theobaldi 581
Siphia albicilla 993
—— hyperythra 667
—— parva 607, 667, 992
—— strophiata 607, 992
Sitta cinnamomeiventris 990
—— frontalis 990
—— himalayensis 605
—— leucopsis 605
Siva cyanuroptera cyanuroptera .. 989
—— strigula 604

NUMBER.
Siva strigula strigula 771
Smilax aspera 696
——— macrophylla 670
Sodada decidua 222
Solanum 547
——— albicaule 547
——— incanum 547
——— indicum 547
——— melongena 547
——— nigrum 547
——— tuberosum 547
——— xanthocarpum 547
Sonchus 537
——— asper 537
——— oleraceus 538
Sopubia 550
——— delphinifolia 550
Sorghum vulgare.. 241
Soriculus 35
——— baileyi 36
——— caudatus 36, 823
——— leucops 36
——— nigrescens 36
Spatula clypeata 191, 598, 620, 842
Spermacoce 532
——— hispida 532
——— stricta 532
Sphæranthus 534
——— indicus 534
Sphenocerus spenurus 618
Spilornis 1007, 1008, 1011
——— cheela .. 180, 617, 1008, 1011
Spiræa bella 695
——— sortifolia 945
Spizaëtus 648, 651
——— limnaëtus .. 631, 648, 649, 651
——— nepalensis 617, 631, 650, 651, 652
Sporobolus 983
——— glaucifolius 983
——— orientalis 983
Sporœginthus amandava .. 589, 995
Stachyrhidopsis pyrrhops .. 424, 603
——— ruficeps ruficeps .. 989
——— rufifrons ambigua .. 989
Stachyrhis nigriceps nigriceps 989

NUMBER.
Stachys sericea 696
Staphidia striata 855
——— ——— rufigensis 989
Stenophyllus 197, 976
——— barbata 197, 976
——— capillaris 197, 198
——— puberula 197, 198
Sterna anglica 188
——— melanogaster 188, 597
——— minuta 294, 597
——— seena 188, 189, 597
Stichopthalma cambodia 868
——— camedava 867
——— godfreyi 867
Stoparola melanops 607, 993
Streptopelia turtur ferrago 775
Striga 549
——— euphrasioides 550
——— orobandcheoides 549
Strix cambayensis 293
——— flammea 178, 293, 592
Sturnia malabarica 992
Sturnopastor contra .. 588, 852, 992
Sturnus menzbieri 380, 992
——— nobilior 380
——— poltaratskyi 380, 381
——— porphyronotus 676
——— vulgaris 293
——— ——— caucasicus .. 293, 381
——— ——— dresseri 383
——— ——— dzungaricus 383
——— ——— humii 381
——— ——— minor 382
——— ——— nobilior 381
——— ——— oppenheimi 383
——— ——— poltaratskyi 380
——— ——— porphyronotus .. 381
——— ——— purpurascens 381
——— ——— sophiæ 382
——— ——— vulgaris 382
——— ——— zaidamensis 383
Suffrenia dichotoma 214
Suœda 968
——— fruticosa 968
Surendra 440

NUMBER.
Surendra aniesena 440
—— florimel 440
—— quercetorum 440
Surniculus lugubris 429, 999
Sus cristatus 825, 1030
—— salvanius 825
Suya crinigera 426, 606, 772
Sylvia affinis 587
Sympetrum 494
—— commixtum .. 495, 496, 498
—— decolorata 497
—— decoloratum 495, 496, 497
—— fonscolombei 495, 496, 497
—— hypomelas .. 495, 496, 498
—— orientale .. 495, 496, 499
—— pallidinervis 926
—— rhæticum 497
—— sanguineum 497
—— sobrina 491
—— striolatum 495
—— subpruinosum 498
—— vulgatum 495, 497
Sypheotis aurita 674
Syrnium indrani 615
—— nivicola 178, 615
—— ocellatum 178, 592

Taccocua leschenault 177, 999
Tachardia lacca 627
Tachornis batassiensis 998
Tadarida 27, 731
—— ægyptiaca 731, 732
—— gossei 732, 733, 1026
—— sindica 732
—— thomasi 732, 733
—— tragata 27
Tadorna cornuta 674, 675
Tagetes 538
—— erecta 538
Tajuria 467
—— cippus .. 461, 463, 464, 465, 466, 467, 468, 469, 472, 765

NUMBER.
Tajuria indra 465, 467
—— jehana 472
—— longinus 471
Tajuris maculata 870
Talpa 34
—— macrura 34
—— micrura 34, 823
Tamarindus 244
—— indica 244
Tamarix 224
—— articulata 224
—— dioica 224
—— gallica 224
—— orientalis 224
Tamiops 378
—— macclellandi 378
—— —— barbei .. 378, 379
—— —— manipurensis. 378, 379
Taphozous 23
—— kachhensis kachhensis 25, 824
—— —— nudaster. .. 25
—— longimanus 25
—— melanopogon 24
—— perforatus 24
—— theobaldi theobaldi .. 24
—— —— secatus 24
Taragama siva 691
Taraxacum officianale 696
Tarsiger chrysæus .. 427, 608, 773
Tarucus 115, 123
—— ananda 121, 123
—— plinius 118, 123, 691
—— theophrastus 115, 118, 123, 127, 691
Tatera 779, 780
—— ceylonica 780, 781
—— cuvieri 780, 781
—— dunni 780, 781
—— hardwickei 780, 781
—— indica .. 664, 780, 781, 1028
—— sherrini 780, 781
Taxila burnii 1022
—— thuisto 1022
—— —— sawaja 1022
Tecomella 551

NUMBER.
Tecomella undulata 551
Tectona grandis 1047
Telchinia violæ 690
Telicota dara 691
Temenuchus pagodarum .. 587, 607
Tephrodornis pelvicus 992
—— pondicerianus .. 587, 992
Tephrosea 238
—— ehrenbergiana 238
—— incana 238, 239
—— multiflora 239
—— pentaphylla 239
—— petrosa 239
—— purpurea 238
—— spinosa 240
—— tenuis 238
—— villosa 238, 239
Terias hecabe 461, 690
—— læta 690
—— libythea 690
—— venata 690
Terminalia paniculata ..449, 457, 467, 480, 761
—— tomentosa 449
Terpsiphone affinis 993
—— paradisi .. 426, 588, 608
Tesia cyaniventris 989
Testudo gigantea 861
Tetraceros quadricornis.. 842
Thaduka 750
—— multicaudata 750
Thamnobia cambaiensis 588, 608
Tharrhaleus atrigularis 610
—— jerdoni 610
—— rubeculoides 609
Thereiceryx lineatus 613, 997
Thespesia populnea .. 624, 625, 628
Tholymis tillarga 686, 687
Tichodroma muraria 605, 991
Tiga shorei 996
Timelia pileata bengalensis 989
Tinnunculus alaudarius .. 182, 593, 618, 846
—— cenchris 183, 846
Tomeutes 370
—— lokroides .. 370, 371, 824

NUMBER.
Tomeutes lokroides lokroides 372
—— —— owensi .. 371, 372
—— mearsi 371
—— —— bellona .. 371, 372
—— —— mearsi 372
—— —— virgo 371, 372
—— phayrei 370
—— —— blanfordi 371
—— —— phayrei 371
—— pygerythrus . .. 370, 371
—— —— janetta 371
—— —— pygerythrus .. 371
Totanus calidris 188, 596
—— glareola 187, 596
—— glottis 188, 596, 620
—— hypoleucus .. 187, 596, 620
—— ochropus .. 187, 590, 596, 620
—— stagnatilis 187
Tragopan 705
—— blythi 891, 892, 900, 903
—— —— blythi .. 706, 892, 900
—— —— molesworthi .. 706, 899
—— caboti 706, 906
—— hastingsi 885
—— melanocephalus. 619, 706, 707, 710, 885
—— satyra .. 706, 707, 710, 715, 889
—— temmincki 706, 901
Tragus 979
—— racemosus 979
Tramea limbata 686
Trapa 527
—— bispinosa 527
Trianthema 530
—— hydaspica 531
—— monogyna 530
—— pentandra 530
—— triquetra 530
Tribulus 230
—— alatus 230
—— terrestris 230
Tribura intermedia 991
—— luteiventris 605, 991
—— thoracica 425, 199
Trichodesma 543

NUMBER.

Trichodesma indicum 543
Tricholepis 537
———— radicans 537
Trichotheca hirta 848
Tridax 536
—— procumbens 536
Trifolium pattense 695
Tringa minuta 188
—— temmincki 188
Trionyx euphraticus 295
Trirhinopholis nuchalis 863
Trithemis 919, 922
—— adelpha 920
—— annulata 920, 922, 923
—— aurora 919, 920, 923
—— —— aurora 686, 687, 920, 921
—— cæsia 735
—— congener 920
—— cyprica 925
—— dryas 926
—— festiva 919, 920, 925
—— fraterna 920
—— fuscopalliata 738
—— infernalis 925
—— intermedia 511, 920
—— kirbyi 919, 920, 923
—— —— kirbyi 920, 923
—— limbata 736
—— liturata 920
—— obsoleta 923
—— pallida 514
—— pallidinervis 686, 687, 919, 920, 926
—— prosperina 925
—— rubrinervis 923
—— soror 920
—— trivialis 503
—— yerburyi 920
Triticum 987
—— vulgare 987
Trochalopteron erythrocephalum erythrocephalum 771
———— lineatum grisescentior 771
———— variegatum variegatum 771
Trochalopterum erythrocephalum 603

NUMBER.

Trochalopterum lineatum 603
———— melanostigma 854, 855
———— phœnicium phœnicium 988
———— variegatum 424, 603
Troglodytes troglodytes neglectus 771
Tropidonotus beddomi 560
———— himalayanus 580
———— monticola 562
———— parallelus 580
———— piscator 560, 862
———— platyceps 862
———— stolatus 562, 863
———— subminiatus 580
Trotula trianthis 216
Trypanophora semihyalina 693
Tupaia 29
—— belangeri belangeri 30
—— —— chinensis 30, 823
—— —— siccata 30
—— —— tenaster 30
—— clarissa 30
—— nicobarica 31
Turdiorus abbotti 855
Turdus merula syriacus 293
—— musicus 609
—— viscivorus 609
Turnix dussumieri 185, 594
—— tanki 594, 620
Turtur cambaiensis 183, 594, 619
—— ferrago 183, 618
—— risorius 183, 594, 619
—— suratensis 183, 594, 619
Tylonicteris fulvida 823
Typhlops 556, 576
—— beddomii 556
—— diversiceps 865
—— fletcheri 554, 556
—— jerdoni 865
—— thurstoni 556

NUMBER.
Upupa epops .. 176, 591, 614, 998
—— indica .. 176, 998
Urochloa .. 978
—— panicoides .. 978
Urocissa flavirostris .. 600
—— occipitalis .. 601
Uroloncha acuticauda .. 994
—— leucogastra .. 856
—— malabarica .. 589
—— punctulata .. 589, 610, 994
Uromastrix microlepis .. 295
Uromycos cunninghamianus .. 697
—— hobsoni .. 697
Ursus .. 350
—— arctus .. 350
—— isabellinus .. 350
—— tibetanus .. 823
—— torquatus .. 350, 351

Vahlia .. 527
—— viscosa .. 527
Valeriana wallichi .. 695
Vallisneria .. 972
—— spiralis .. 972
Vandeleuria .. 785, 962
—— dumeticola .. 824, 962, 963
—— nilagirica .. 962, 963
—— oleracea .. 782, 962, 963
—— —— marica .. 963, 964
—— —— modesta .. 964
—— —— oleracea .. 963, 1028
—— —— spadicea .. 964
—— rubida .. 963
Vanellus cristatus .. 294
—— vulgaris .. 186
Vanessa cardui .. 689, 1046
Varanus griseus .. 295
Vernonia .. 533
—— cinerascens .. 533
—— cinerea .. 533
Vespa dorylloides .. 301, 302

NUMBER.
Vicia tenera .. 695
Vicoa .. 534
—— auriculata .. 534
Vigna .. 242
Viola .. 222
—— stocksii .. 222
Vipera russelli .. 577
Virachola isocrates .. 952, 953
—— perse .. 769
Viscum angulatum .. 462
—— capitellatum .. 462, 465
Vitex .. 813
—— negundo .. 462, 813
Vitis lanceolaria .. 622
—— vinifera .. 234
Viverra .. 46
—— civettina .. 46, 47
—— megaspila .. 46, 47
—— zibetha .. 46, 822
—— —— pruinosa .. 46
—— —— zibetha .. 46
Viverricula .. 47
—— malaccensis .. 47, 822, 1032
Volutarella .. 537
—— divaricata .. 537
Vormela .. 344
—— peregusna .. 344
—— sarmaticus .. 344
Vulpes .. 341
—— alopex .. 341
—— bengalensis .. 341, 660, 823
—— cana .. 341, 342
—— ferrilatus .. 341, 342
—— leucopus .. 341, 342
—— montana .. 341, 342
Vultur .. 252
—— monachus .. 178, 179, 249, 250, 252, 260, 616

Walkeriana cinerea .. 628
Wedelia .. 536
—— urticæfolia .. 536

NUMBER.

Withania 548
——— somnifera 548
Wrightia 539
——— tinctoria 539

Xantholæma hæmatocephala .. 175, 591, 613, 997
Xanthotænnia busiris 869, 870
Xenorhynchus asiaticus 189
Xylia dolabriformis .. 139, 449, 951
Xylophis perroteti 564, 576

Ypthima chenui 871
——— huberni 689
——— philomela 871
——— ypthimoides 871
Yuhina gularis gularis 989
——— nigrimentum 989

Zaocys dhumnades 581
——— mucosus 566, 575
Zea 980
—— mays 980
Zeltus 753
——— etolus tabricius 753

NUMBER.

Zemeros flegyas 1022
——— ——— allica 1022
——— ——— indicus 1022
Zepherus icana 870
Zeuxidia masoni 869, 870
Zezius 455
——— chrysomallus 455
Zinaspa 455
Zizera gaika 691
——— lysimon 691
——— maha 691
——— otis 691
Zizyphus 123, 233
——— jujuba 233, 477, 625
——— œnoplia 129
——— rotundifolia 222, 234
——— rugosa 127, 477, 948
——— trinervia 234
——— truncata 234
——— xylopyra 234
——— xylorpyrus 948
Zoothera marginata 994
——— monticola .. 609, 668, 669, 994
Zosterops palpebrosa 604, 989
——— simplex 989
Zygonidia ceylanica 741
——— insignis 741
——— malayana 741
——— ænea 741
Zygonyx 740
——— ida 741
——— ilia 741
——— iris 740, 741
Zygophyllum 231
——— simplex 231
Zyxomma petiolatum 686, 687

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CONTENTS OF THIS NUMBER.

PAGE

THE GAME BIRDS OF INDIA, BURMA AND CEYLON. Part XXV. (With a Plate of *Catreus wallichi*, the Cheer Pheasant.) By E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U. 1

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY OF THE BOMBAY NATURAL HISTORY SOCIETY. Part II. By R. C. Wroughton, F.Z.S. 19

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, No. XVIII. Report on the House Rats of India, Burma and Ceylon. By Martin A. C. Hinton 59

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part XXVI. (With Plate XXVI and Diagram of *Cerberus rhyncops* and *Enhydrina curtus*.) By Lt.-Col. F. Wall, C.M.G., C.M.Z.S., F.L.S., I.M.S. 89

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXI. By T. R. Bell, I.F.S. 98

INDIAN DRAGONFLIES. Part III. (With 12 Text-figures.) By Major F. C. Fraser, I.M.S. 141

NOTES ON THE BIRDS OF AMBALA DISTRICT, PUNJAB. Part II. By H. Whistler, M.B.O.U., F.Z.S. 172

THE CYPERACEÆ OF THE BOMBAY PRESIDENCY. Part II. By L. J. Sedgwick, F.L.S., I.C.S. 192

A REVISION OF THE INDIAN SPECIES OF *Rotala* AND *Ammannia*. Part II. By E. Blatter, S. J., and Prof. F. Hallberg 210

THE FLORA OF THE INDIAN DESERT. (Jodhpur and Jaisalmer). Part I. (With 12 Plates.) By E. Blatter, S. J., and Prof. F. Hallberg 218

THE BIRDS OF PREY OF THE PUNJAB. Part I. (With 2 Diagrams.) By C. H. Donald, F.Z.S. 247

PANTHERS. By Brig.-General R. G. Burton 266

THE MESOPOTAMIAN BULBUL. By Capt. Claud B. Ticehurst, R.A.M.C. 279

MISCELLANEOUS NOTES :—

1.—Notes on a Young Hog Badger (*Arctonyx* Sp.) in the Garo Hills. By V. A. Jackson 281

Further Notes on the Hog Badger. By V. A. Jackson 281

CONTENTS OF THIS NUMBER—(*contd.*)

PAGE

II.—Porcupine's mode of attack. By Reginald H. Heath 282

III.—Method of Porcupine's attack. By Lt.-Col. E. O'Brien 283

IV.—Method of Porcupine's attack. By F. J. Mitchell .. 283

V.—The Beatrix or Arabian Oryx (*Oryx leucoryx*) in Central Arabia. (With a Plate.) By Lt.-Col. R. E. A. Hamilton.................................. 283

VI.—Notes on a Takin Head from Assam. By J. P. Mills, I.C.S. 284

VII.—Panic in Elephants during an Earthquake. By V. A. Jackson, F.R.G.S. 285

VIII.—On White Elephants. H. Macnaghten 285

IX.—The White-Cheeked Bulbul (*Molpastes leucogenys.*) By Brig.-Genl. R. M. Betham 286

X.—The Plumage of the Purple Honeysucker (*Arachnothura asiatica*). By Capt. Claud B. Ticehurst, R.A.M.C.. 286

XI.—Note on the Indian Long-Billed Vulture (*Gyps indicus*). By W. H. Mathews, I.P.................. 287

XII.—The Common Hawk-Cuckoo (*Hierococcyx varius*) in the Punjab. By Hugh Whistler, F.Z.S., Indian Police.. 287

XIII.—The Breeding habits of Mrs. Hume's Pheasant. By Capt. R. Blandy 289

XIV.—Notes on Kalij Pheasants in the Chin Hills. By Capt. R. Blandy 289

XV.—Occurrence of the Lesser Florican or Likh *S. aurita* in the Mahableshwar Hills. By Kyrle Fellowes...... 289

XVI.—Abnormal Varieties of the Indian Redstart (*R. rufiventris*) and the Common House Crow (*C. splendens*). By Hugh Whistler, F.Z.S., Indian Police 289

XVII.—The Colour of the eye of the female White-Eyed Pochard (*Nyroca africana*). By Capt. Claud B. Ticehurst, R.A.M.C. 290

XVIII.—Notes on the habits of the Mallard (*Anas boschas*). By Lt.-Col. E. J. D. Colvin....................... 291

XIX.—An Addition to the Game Birds of Burma. The Long-Billed Hill Partridge (*Rhizothera longirostris*, Temm.) in Tenasserim. By Chas. M. Inglis, M.B.O.U. 291

XX.—Natural History Notes from Fao. By W. D. Cumming 292

XXI.—How Trout were introduced into Kashmir. By F. J. Mitchell 295

XXII.—Notes on the Larva of *Chærocampa alecto*. By Capt. F. B. Scott, I.A.. 299

CONTENTS OF THIS NUMBER—(*contd.*)

PAGE

XXIII.—Life History of the *Antheræa roylei* (Oak Emperor) Moth. By C. W. Allan 300
XXIV.—A Flight of Locusts. (With a Plate.) By E. C. B. Acworth 301
XXV.—Nesting Habits of *Vespa dorylloides*, Sauss. By C. F. C. Beeson, M.A., I.F.S. 301
XXVI.—Mimicry in Spiders. By F. Clayton 302
XXVII.—On the breeding habits of some *Myriapoda*. By C. McCann...................................... 303
XXVIII.—Note on a New undesribed Species of Cynodon. (With a Plate.) By K. Rangachari and C. Tadulingam.. 304
XXIX.—A Variety of *Butea frondosa*. By Lt.-Col. C. E. Luard.. 305
XXX.—The Edible Date-Palm in Bombay. By E. Blatter, S.J.. 306
XXXI.—Oleander poisoning Camels. By Capt. J. E. B. Hotson, I.A.R.O. 306
XXXII.—Notes from the Oriental Sporting Magazine. New Series, 1869 to 1879. By Lt.-Col. R. W. Burton, I.A. 309
XXXIII.—Nilgiri Trap for catching wild animals. By Capt. Philip Gosse, R.A M.C. 311
XXIV.—*Eleocharis congesta*, Don., in the Bombay Presidency. By L. J. Sedgwick, I.C.S. 312

PROCEEDINGS .... 313—318

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CONTENTS OF THIS NUMBER.

PAGE

THE GAME BIRDS OF INDIA, BURMA AND CEYLON. Part XXVI. (With a Plate of *Lophophorus impejanus*, the Impeyan Pheasant or Monal). By E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U. 319

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY OF THE BOMBAY NATURAL HISTORY SOCIETY. Part III. By R. C. Wroughton, F.Z.S. 338

ON ASIATIC STARLINGS. By Capt. C. B. Ticehurst, R.A.M.C. 380

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, No. XVIII (contd.). Report on the House Rats of India, Burma and Ceylon. By Martin A. C. Hinton......... 384

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, No. XIX. A Synopsis of the Groups of True Mice found within the Indian Empire. By Oldfield Thomas, F.R.S. 417

A NEW SPECIES OF NESOKIA FROM MESOPOTAMIA. By Oldfield Thomas, F.R.S. 422

SUPPLEMENTARY NOTES ON SOME INDIAN BIRDS. By B. B. Osmaston, C.I.E., I.F.S. 424

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part XXVII. (With Plate XXVII and Diagram of *Hydrophis spiralis* and *Hydrophis cyanocinctus*.) By Lt.-Col. F. Wall, C.M.G., C.M.Z.S., F.L.S., I.M.S. 430

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXII. (With Plate H.). By T. R. Bell, C.I.E., I.F.S. 438

INDIAN DRAGONFLIES. Part IV. (With 14 Text-figures.) By Major F. C. Fraser, I.M.S. 488

SUB-SPECIES AND THE FIELD NATURALIST. By E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U. 518

THE FLORA OF THE INDIAN DESERT. (Jodhpur and Jaisalmer). Part II. (With 13 Plates.) By E. Blatter, S.J., and Prof. F. Hallberg 525

NOTES ON A COLLECTION OF SNAKES MADE IN THE NILGIRI HILLS AND THE ADJACENT WYNAAD. (With Diagrams and Maps.) By Lt.-Col. F. Wall, I.M.S., C.M.G., C.M.Z.S. 552

SOME BIRDS OF LUDHIANA DISTRICT, PUNJAB. By H. Whistler, F.Z.S., M.B.O.U. ...., ... 585

REDUCTION OF *Euphorbia rothiana*. By L. J. Sedgwick, F.L.S., I.C.S. 599

A LIST OF BIRDS FOUND IN THE SIMLA HILLS, 1908-1918. By A. E. Jones 601

SOME SOUTH INDIAN COCCIDS OF ECONOMIC IMPORTANCE. (With 4 Plates.) By T. V. Ramakrishna Ayyar, B.A., F.E.S., F.Z.S. 621

THE BIRDS OF THE PREY OF THE PUNJAB. Part II. (With Plates I and II.) By C. H. Donald, F.Z.S. 629

PROGRESS OF THE MAMMAL SURVEY 656

CONTENTS OF THIS NUMBER—(contd.)

PAGE

MISCELLANEOUS NOTES :—

I.—The Tiger and the Train. By A. A. Dunbar Brander, I.F.S. 658
II.—Arrow head imbedded in a Tiger's back. By J. G. Ridland 658
III.—Size of Tigers. By Lt.-Col. R. Light 659
IV.—Tigress (*Felis tigris*) attacking a Sloth Bear (*Melursus ursinus*). By J. A. Duke 659
V.—Mongoose (*Mungos mungo*) killing a Hedgehog. By Lt.-Col. E. O'Brien 660
VI.—Natural Death of a Fox (*Vulpes bengalensis*). By G. O. Allen, I.C.S. 660
VII.—Spotted Deer (*Axis axis*) and the Wild Dogs (*Cuon dukhunensis*). By. J. A. Duke 661
VIII.—Expected Plague of Field Rats in 1920. By L. J. Sedgwick, I.C.S. 661
IX.—Porcupines method of shedding quills when attacked. By Lt.-Col. R. Light 666
X.—Record Female Nilgiri Tahr (*Hemitragus hylocirius*). By Lt. A. P. Kinloch.......................... 666
XI.—Indian Grey Shrike (*Lanius lathora*) attacking wounded Sandgrouse. By Lt.-Col. E. O'Brion .. 667
XII.—Occurrence of Indian Red Breasted Flycatcher (*Siphia hyperythra*) in the Deccan. By A. J. Currie .. 667
XIII.—Nesting habits of the Brown Rockchat (*Cercomela fusca*). By L. S. White 667
XIV.—A Note on the large Brown Thrush (*Zoothea monticola*). By S. J. Martin 668
XV.—Nidification of the Small Streaked Spider-hunter (*Arachnothera aurata*). By J. M. D. Mackenzie, I.F.S., M.B.O.U., F.Z.S. 669
XVI.—The Malabar Pied Hornbill (*Anthracoceros coronatus*) in Mirzapur, U. P. By G. O. Allen, I.C.S. 671
XVII.—The Cuckoo (*Cuculus canorus*) in Mirzapur, U. P. By G. O. Allen, I.C.S.............................. 671
XVIII.—Extension of Range of the Bronze-winged Dove. By H. Dawson.................... 672
XIX.—Habits of the Painted Sandgrouse (*Pterocles fasciatus*). By G. O. Allen, I.C.S. 672
XX.—Sand Grouse in Mesopotamia. By Lt.-Col. H. A. F. Magrath 672
XXI.—The Burmese Peafowl (*Pavo muticus*) in the Chittagong Hill Tracts, Bengal. By C. M. Inglis 673
XXII.—Nidification of Stone's Pheasant (*Phasianus elegans*). A Correction. By C. M. Inglis 673
XXIII.—The Great Indian Bustard (*Eupodotis edwardsi*) in Mirzapur District, U. P. By G. O. Allen, I.C.S. 673
XXIV.—Note on the occurrence of the Lesser Florican or Likh (*Syphoetis aurita*) in Bombay. By N. Marryat. 674

CONTENTS OF THIS NUMBER—(*contd.*)

PAGE

MISCELLANEOUS NOTES—*contd.*

XXV.—The Cotton Teal in Malabar. By A. M. Kinloch .. 674
XXVI.—Occurrence of the Common Sheldrake (*Tadorna cornuta*) and the Marbled Duck (*Marmaronetta angustriostris*) in Kathiawar. By Lt.-Col. H. W. Berthon. 674
XXVII.—Spot Bill Duck in Kashmir. By Major D. G. Oliver. 675
XXVIII.—The Sheldrake (*Tadorna cornuta*) in Manipur State. By J. C. Higgins, I.C.S. 675
XXIX.—Further Notes on the Birds of Ambala District, Punjab. By A. E. Jones 675
XXX.—List of Birds observed in the Euphrates Valley. By Major-General H. T. Brooking 677
XXXI.—Large Carp from Mesopotamia. By Major R. Bagnall 679
XXXII.—Large Carp from Mesopotamia. By Brig.-General H. Mackay, R.A. 680
XXXIII.—The Habits of the Tree Frog (*Rhacophorus maculatus*). By G. O. Allen, I.C.S. 681
XXXIV.—The Habits of (*Dryophis mycterizans*). By A. M. Kinloch. 681
XXXV.—The Bite of the Large Spotted Viper (*Lachesis monticola*). By A. Wright 681
XXXVI.—Remarks on Col. Wall's identification of (*Hydrophis cyanocinctus*). By Malcolm A. Smith, F.Z.S. 682
XXXVII.—Notes on Some Interesting Snakes recently presented to this Society. By S. H. Prater 683
XXXVIII.—The Undescribed female of an Indian Dragonfly (*Hemicordulia asiatica*). By Major F. C. Fraser, I.M.S. 685
XXXIX.—Libellulines at St. Thomas' Mount, Madras. By H. R. Rishworth 685
XL.—A Note on the function of the "Forceps" in Forficulidæ. By Lt.-Col. F. Powell Conner, I.M.S. .. 688
XLI.—Some Butterflies taken in Benares and Adjoining Districts. By G. O. Allen, I.C.S. 689
XLII.—Notes on the Emergence from the Cocoon in *Lasiocampidæ*. By Lt.-Col. F. P. Connor, I.M.S. 691
XLIII.—Tenacity of Life of (*Parapelybia orientalis*). By G. O. Allen, I.C.S. 693
XLIV.—Protective habits of the Larva of (*Trypanophora semihyalina*). By G. O. Allen, I.C.S. 693
XLV.—Note on the supposed effects of the bite of a Pentatomid Bug (*Halys dentatus*). By E. H. Hunt. 694
XLVI.—A few Additions to the List of Mussoorie Plants, by James Marten, in Vol. XIX, p. 475. By G. O. Allen, I.C.S. 695
XLVII.—On the Identity of (*Blastospora butleri*), Syd. (With a Plate). By S. L. Ajrekar, B.A. 697
Proceedings .... 698—703

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CONTENTS OF THIS NUMBER.

PAGE

THE GAME BIRDS OF INDIA, BURMA AND CEYLON. Part XXVII. (With a coloured Plate of *Tragopan*). By E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U. 705

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, No. XVIII (contd.). Report on the House Rats of India, Burma and Ceylon. By Martin A. C. Hinton......... 716

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, No. XX. By Oldfield Thomas, F.R.S. 726

A.—Notes on the Genus *Cheliones.*

B.—Change of coat in the Common Palm Squirrel—An Appeal. By R. C. Wroughton, F.Z.S.

C.—Two new forms of the *Funambulus tristriatus* Group. By R. C. Wroughton and Winifred M. Davidson.

D.—On the Genus *Tadarida* (Wrinkle-Lip Bats). By R. C. Wroughton, F.Z.S. ....

INDIAN DRAGONFLIES. Part V. (With Text-figures.) By Major F. C. Fraser, I.M.S.................................. 734

SOME NEW MAMMALS FROM MESOPOTAMIA. By Oldfield Thomas, F.R.S., F.Z.S. 745

COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXIII. By T. R. Bell, C.I.E., I.F.S. 750

SOME BIRDS OBSERVED AT FAGOO, NEAR SIMLA. By H. Whistler, F.Z.S., M.B.O.U. 770

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY OF THE BOMBAY NATURAL HISTORY SOCIETY. Part IV. By R. C. Wroughton, F.Z.S. 776

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part XXVIII. (With a coloured Plate XXVIII and Diagram). By Lt.-Col. F. Wall, C.M.G., C.M.Z.S., F.L.S., I.M.S....... 803

THE FLORA OF THE INDIAN DESERT. (Jodhpur and Jaisalmer). Part III. (With 6 Plates.) By E. Blatter, S.J., and Prof. F. Hallberg 811

A TENTATIVE LIST OF THE VERTEBRATES OF THE JALPAIGURI DISTRICT, BENGAL. (With Plates.) By Chas. M. Inglis, M.B.O.U., W. L. Travers, H. V. O'Donel and E. O. Shebbeare, I.F.S... 819

THE BIRDS OF PREY OF THE PUNJAB. Part III. (With Plate I.) By C. H. Donald, F.Z.S. 826

CONTENTS OF THIS NUMBER—(*contd.*)

PAGE

MISCELLANEOUS NOTES :—

I.—Note on the Malabar Slender Loris, *Loris lydekkerianus*. By N. B. Kinnear, C.M.Z.S. 836

II.—Tiger, *Felis tigris*, climbing tree. By G. Monteath, B.A., I.C.S. 837

III.—Wild Dogs, *Cuon dukhunensis*, and Sambhur. By F. Ware 837

IV.—Distribution of the different races and species of Takin (*Budorcas*). By F. Kingdon-Ward 838

V.—Notes on the Big Game and Duck of Dhar State. By Udaji Rao Puar, K.C.S.I., K.B.E., *Maharaja of Dhar* 841

VI.—Variety of the Common House Crow (*Corvus splendens*) at Jhang, Punjab. By Hugh Whistler, F.Z.S. 843

VII.—Maternal instinct in the Pied Bush Chat (*Pratincola caprata*). By S. M. Robinson 843

VIII.—Nesting habits of the Brown Rockchat (*Cercomela fusca*). By W. H. Mathews 843

IX.—An Albino Swallow. By W. H. Mathews.......... 844

X.—Abnormal variety of the Green Bee-Eater. (*Merops viridis*). By Hugh Whistler, F.Z.S. 844

XI.—Some Birds of Prey of Mesopotamia. By C. H. Donald, F.Z.S. 845

XII.—Extension of Range of the Green Imperial Pigeon (*Carpophaga ænea ænea*) in Western India. By N. B. Kinnear, C.M.Z.S. 846

XIII.—Extracts from "A Monograph of the Pheasants by William Beebe." By Chas. M. Inglis, M.B.O.U..... 847

XIV.—The Black-Breasted Kalij Pheasant (*Gennæus horsfieldi horsfieldi*) east of the Irrawaddy. By Chas. M. Inglis, M.B.O.U 848

XV.—A Note on the breeding of the Hill Partridge (*Arboricola torqueola*) near Simla. By Hugh Whistler, F.Z.S.............................. 849

XVI.—Late stay of Common Snipe (*Gallinago cœlestes*) in Central India. By Percy Hide 849

XVII.—Late stay of Pin-tail Snipe (*Gallinago stenura*) in Burma. By A. F. M. Slater................... 850

XVIII.—Migration of Snipe in Burma. By E. T. Kenny 850

XIX.—Feeding habits of the Little Egret (*Herodias garzetta*.). By H. R. Meredith 852

XX.—Further occurrence of the Rose-coloured Starling (*Pastor roseus*) and the Flamingo (*Phœnicopterus roseus*) in the Darbhanga District, Behar. By Chas. M. Inglis, M.B.O.U...................... 853

XXI.—Different Birds nesting in company. By W. Mathews 853

CONTENTS OF THIS NUMBER—(*contd.*)

PAGE

MISCELLANEOUS NOTES—*contd.*

XXII.—Notes on some Nests recently found in South Tenasserim. By Cyril Hopwood, M.B.O.U. 853
XXIII.—Mesopotamian Bird Notes. By F. C. R. Jourdain .. 860
XXIV.—The Giant Tortoise living in Ceylon. (With a Plate). By N. B. Kinnear, C.M.Z.S. 861
XXV.—The rudimentary hind limb in an Embryo of *Python molurus.* By Lt.-Col. F. Wall, I.M.S. 862
XXVI.—The habits of the Green Whip Snake *Dryophis mycterizans.* By J. F. Cains, S.J. 862
XXVII.—Note on the Snake *Trirhinopholis nuchalis* (Boulenger). By Lt.-Col. F. Wall, I.M.S. 863
XXVIII.—A Gravid Specimen of the Snake *Cylindrophis maculatus* (Linn.). By Lt.-Col. F. Wall, I.M.S. 863
XXIX.—Reply to Dr. Malcolm Smith's remarks in the last Journal. By Lt.-Col. F. Wall, I.M.S. 864
XXX.—Notes on some recent additions to our Society's Snake collection. By Lt.-Col. F. Wall, I.M.S. 865
XXXI.—Occurrence of *Stichopthalma godfreyi* (Roths). By O. C. Ollenbach 867
XXXII.—Occurrence of *Colotis vestalis* and *amata* at Unao. By G. O. Allen, I.C.S. 868
XXXIII.—Early appearance of *Pieris brassicæ* (Linn.) in the Darbhanga District, Behar. By Chas. M. Inglis.. 869
XXXIV.—Notes on the habits of Butterflies *Zeuxidia masoni* and *Xanthotænnia busiris.* By O. C. Ollenbach 869
XXXV.—Naini Tal Butterfly Notes. By G. O. Allen, I.C.S..... 870
XXXVI.—Life History Notes on Coorg Butterflies. By F. Hannyngton, I.C.S. 871
XXXVII.—The Hawk Moth (*Deilephila livornica*). A correction. By Capt. F. B. Scott, I.A. 872
XXXVIII.—*Harpactor costalis,* Stal., preying on *Ceratina viridissima,* D. T. By Chas. M. Inglis, M.B.O.U. .. 872
XXXIX.—Notes on the Flying White Ant and Scorpions that feed on them. By C. H. Dracott 873
XL.—Notes on some new and other Indian Dragonflies. By Major F. C. Fraser, I.M.S. 874
XLI.—Ants attacking Bees. By A. G. H. Breithaupt 878
XLII.—Habits of Earthworms. By G. O. Allen, I.C.S....... 879

Review. A practical handbook of British Birds 880
Proceedings 882

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CONTENTS OF THIS NUMBER.

PAGE

THE GAME BIRDS OF INDIA, BURMA AND CEYLON. Part XXVIII. By E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U. 885

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, No. XVIII (concld.). Reports on the House Rats of India, Burma and Ceylon. By Martin A. C. Hinton 906

INDIAN DRAGONFLIES. Part VI. (*With Text-figures*). By Major F. C. Fraser, I.M.S. 919

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY, No. XXI. By Oldfield Thomas, F.R.S. 933

A.—Some New Mammals from Baluchistan and North-West India.

B.—Two new Species of *Calomyscus*. By Oldfield Thomas, F.R.S. 938

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXIV. By T. R. Bell, C.I.E., I.F.S. 941

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY OF THE BOMBAY NATURAL HISTORY SOCIETY. Part V. By R. C. Wroughton, F.Z.S. 955

THE FLORA OF THE INDIAN DESERT. (Jodhpur and Jaisalmer.) Part IV. By E. Blatter, S. J., and Prof. F. Hallberg 968

A TENTATIVE LIST OF THE VERTEBRATES OF THE JALPAIGURI DISTRICT, BENGAL. Part II. (*With a Plate, Map and Text Block.*) By Chas. M. Inglis, M.B.O.U., W. L. Travers, H. V. O'Donel and E. O. Shebbeare, I.F.S. ... 988

THE BIRDS OF PREY OF THE PUNJAB. (*With Text-Figures,*) Part IV. By C. H. Donald, F.Z.S. 1000

NOTES ON INDIAN BUTTERFLIES. By Lt.-Col. W. H. Evans, F.Z.S., F.E.S. 1021

DESCRIPTION OF A NEW SNAKE OF THE GENUS *Contia*, B. & G., FROM PERSIA. By G. A. Boulenger 1024

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON. Report Nos. 30, DEKHAN (POONA DISTRICT), and 31, NILGIRIS 1025

PROGRESS OF THE MAMMAL SURVEY 1036

OBITUARY NOTICES: F. Hannyngton, I.C.S., E. W. Ellis, I.F.S. 1037

CONTENTS OF THIS NUMBER—(*contd.*)

PAGE

MISCELLANEOUS NOTES :—

I.—Large Kashmir Stag Head (*Cervus cashmirianus*) (*with text block*). By C. Gilbert Rogers 1038

II.—Porcupine's method of attack. By C. R. S. Pitman. 1039

III.—Porcupine's method of attack. By Randolph C. Morris 1040

IV.—Caracal (*Felis caracal*) and Hunting Leopard (*Cynælurus jubatus*) in Mirzapur, U. P. By G. O. Allen, I.C.S. 1041

V.—Field Rats in the Deccan in 1879. By J. Davidson. 1042

VI.—Note on the eggs of *Prinia inornata*, The Indian Wren-Warbler. By F. Reed 1043

VII.—Note on the Nightjar (*Caprimulgus ægypticus*). By Major W. M. Logan Home 1043

VIII.—Strange behaviour of a wild bird. By Major J. E. M. Boyd 1043

IX.—The Blue-breasted Quail (*Excalfactoria chinensis*) at Mirzapur. By H. Whistler, F.Z.S., M.B.O.U. 1044

X.—Birds of different species nesting in company. By G. O. Allen, I.C.S. 1044

XI.—The Red Turtle-Dove (*Œnopepelia t. tranqebarica*) in Unao, U. P. By G. O. Allen, I.C.S. 1044

XII.—Accidents to Vultures. By G. O. Allen, I.C.S. 1045

XIII.—Hovering habit of the Spotted Owlet (*Athene brahma*). By G. O. Allen, I.C.S. 1045

XIV.—A 17 Scale Krait (*Bungarus cæruleus*) from Bangalore. By Lt.-Col. F. Wall, I.M.S. 1046

XV.—Early occurrence of the Painted Lady (*Vanessa cardui* L.) in the Darbhanga District, Behar. By Chas. M. Inglis 1046

XVI.—A curious method of feeding noted in *Danais limniace*, Cram. By T. V. Subrahmaniam 1047

XVII.—Notes from the Oriental Sporting Magazine, June 1828 to June 1833. By Lt.-Col. R. W. Burton, I.A. 1047

XVIII.—An Anomaly in Floral Biology. By. S. P. Jivanna Rao, M.A. 1049

Accounts for 1918 1051

Proceedings 1053

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7

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Title Page	Frontispiece.
Contents of Vol. XXVI ...	To follow the frontispiece in this order.
List of Contributors	
List of Plates	
Index to Illustrations	
New Generic Terms	
Errata	
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